N A T U R A L R E S O U R C E S

Eelgrass abundance and depth distribution in East Kitsap

Final report to the Suquamish Tribe
DNR IAA 15-17 Amendment 1

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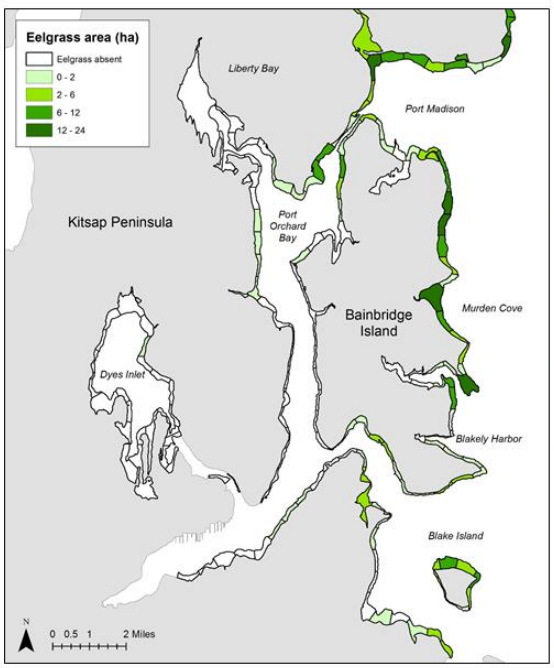
10 Aug 2018



PUGET SOUND ECOSYSTEM MONITORING PROGRAM

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

The Nearshore Habitat Program supports the Washington State Department of Natural Resources' stewardship responsibilities for state-owned aquatic lands. It is also a component of the Puget Sound Ecosystem Monitoring Program (PSEMP) (http://sites.google.com/site/pugetsoundmonitoring/).

Cover Photo: *Brandon DII,* Photo by DNR

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Acknowledgements

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The following document fulfills deliverable 5.1 for Inter-Agency Agreement no. 15-17 Amendment 1 between the Washington Department of Natural Resources and the Suquamish Tribe.

The principal authors of this report include Bart Christiaen, Jeff Gaeckle, and Lisa Ferrier. Several people played a critical role in the video data collection and post-processing for the work summarized in this report including Jessica Olmstead and Cailan Murray.

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Executive Summary

The Washington State Department of Natural Resources (DNR) manages 2.6 million acres of state-owned aquatic lands for the benefit of current and future citizens of Washington State. DNR's stewardship responsibilities include protection of native seagrasses such as eelgrass (*Zostera marina*), an important nearshore habitat in greater Puget Sound. DNR monitors the status and trends of native seagrass throughout greater Puget Sound using underwater videography.

This report synthesizes results from eelgrass surveys conducted under a series of interagency agreements. In 2014, the Suquamish Tribe signed an interagency agreement with DNR to collect baseline eelgrass area and depth distribution data within their usual and accustomed fishing area, including 62 sample sites along the eastern Kitsap Peninsula and Bainbridge Island, using methods standardized by DNR's Submerged Vegetation Monitoring Program (SVMP). In 2016, the Suquamish Tribe and DNR signed an amendment to this contact to include an additional 50 sample sites. That same year, DNR also signed a contract with the City of Bainbridge Island to sample an additional 19 sites along the shoreline of Bainbridge Island.

Between 2014 and 2016, DNR sampled 190 sites along the shoreline of East Kitsap Peninsula and Bainbridge Island (referred to as the East Kitsap Study Area in this report). This is 59 sites more than originally planned, which was made possible by sampling efficiencies. Nine additional sites in the area have been sampled as part of DNR's Submerged Vegetation Monitoring Program (although some of these sites date from before 2014). As a result, we have information on the distribution of eelgrass for the entire shoreline of Bainbridge Island and most of the shoreline of East Kitsap Peninsula between Foulweather Bluff and the northern reaches of Colvos Passage.

This effort supplements existing and planned future sampling by the SVMP, and significantly increases the certainty in local estimates of eelgrass area and depth distribution over existing data. In addition, these surveys establish a baseline for future studies to document trends and depth distribution of eelgrass on both local and regional spatial scales.

Key Findings:

- The East Kitsap Study Area consists of 208 potential sample sites. In 2014, DNR sampled 95 of those sites as part of IAA 15-17. In 2016, DNR sampled an additional 71 sites as part of IAA 15-17 Amendment 1, and 24 sites as part of an interagency agreement with the City of Bainbridge Island (IAA 16-239). Including the 9 sites sampled as part of the SVMP, we have sampled over 95% of the East Kitsap Study Area. Unsampled sites are predominantly located in Sinclair Inlet and near Dyes Inlet, where it is unlikely that eelgrass is present.

- Out of the 199 sites sampled in the East Kitsap Study Area, there are 81 sites without eelgrass. Sites without eelgrass are predominantly located in Port Orchard Bay, Sinclair Inlet, Dyes Inlet and Liberty Bay. Within the study area, eelgrass is most abundant along the northeastern Kitsap Peninsula and the eastern shore of Bainbridge Island.

- The non-native *Zostera japonica* is widespread throughout the study area. *Zostera japonica* was present in 58 out of 199 sites sampled. This non-native seagrass is mostly found in association with native eelgrass beds. There are only 4 locations with *Zostera japonica* where native eelgrass is absent.

- Our current best estimate is that there is approximately 598 ha of eelgrass along the shoreline the East Kitsap Study Area. This is roughly 18.5% of the current best estimate for eelgrass area in Central Puget Sound, and less than 3 % of all eelgrass in greater Puget Sound. The majority of eelgrass is found along the upper part of the Kitsap Peninsula.

- Approximately 90 % of all eelgrass along the shoreline of the East Kitsap Study Area grows between 0 and -4.5 m relative to Mean Lower Low Water (MLLW). The median depth is approximately -1.5 m (MLLW). Overall, the depth distribution of eelgrass in the East Kitsap Study Area is very similar to other sites in Central Puget Sound, but more restricted as compared to the San Juan Islands and the Strait of Juan de Fuca.

- Eelgrass grows to greater maximum depths along the eastern shores of Bainbridge Island and Kitsap Peninsula, as compared to sites near Port Orchard and Sinclair Inlet. However, there is a lot of variability in maximum eelgrass depth among individual sites.

1 Introduction

Eelgrass (*Zostera marina*) is a flowering plant that grows submerged in marine and estuarine environments. Eelgrass provides a wide range of important ecosystem services. In Puget Sound, eelgrass offers spawning grounds for Pacific herring (*Clupea harengus pallasi*), out-migrating corridors for juvenile salmon (*Oncorhynchus* spp.) (Phillips 1984, Simenstad 1994), and important feeding and foraging habitats for waterbirds such as the black brant (*Branta bernicla*) (Wilson and Atkinson 1995) and great blue heron (*Ardea herodias*) (Butler 1995). In addition, eelgrass provides valued hunting grounds and ceremonial foods for Native Americans and First Nation People in the Pacific Northwest (Suttles 1951, Felger and Moser 1973, Kuhnlein and Turner 1991, Wyllie-Echeverria and Ackerman 2003).

Eelgrass is usually found on soft substrates, such as sand and mud. It tends to grow in relatively shallow environments, and is often limited by light availability. Eelgrass responds quickly to anthropogenic stressors such as physical disturbance, and reduction in sediment and water quality due to excessive input of nutrients and organic matter. This makes eelgrass an effective indicator of habitat condition (Dennison et al. 1993, Short and Burdick 1996, Lee et al. 2004, Kenworthy et al. 2006, Orth et al. 2006).

Since 2000, the Nearshore Habitat Program at the Washington State Department of Natural Resources has collected annual data on the status of eelgrass throughout Puget Sound as part of the Submerged Vegetation Monitoring Program (SVMP). The SVMP is one component of the broader Puget Sound Ecosystem Monitoring Program (PSEMP), a multi-agency monitoring program coordinated by the Puget Sound Partnership. The monitoring data is used to characterize the status of native seagrass and is one of 25 vital signs used by the Puget Sound Partnership to track progress in the restoration and recovery of Puget Sound (PSP 2014).

The Submerged Vegetation Monitoring Program estimates soundwide eelgrass area (and associated uncertainty) by sampling a limited number of sites throughout the entire greater Puget Sound, according to a statistical design. The soundwide study is complemented by targeted studies aimed at surveying entire stretches of shoreline in greater detail. Previously, DNR has completed detailed surveys of eelgrass in Quartermaster Harbor, and along the shoreline of Bellingham Bay.

In 2014, the Suquamish Tribe signed an interagency agreement with DNR to collect baseline eelgrass area and depth distribution data within a portion of their usual and accustomed fishing area, including 62 sample sites along the eastern Kitsap Peninsula and Bainbridge Island, using methods standardized by DNR’s Submerged Vegetation Monitoring Program (SVMP). In 2016, the Suquamish Tribe and DNR signed an amendment to this contact to include an additional 50 sample sites. DNR signed a separate agreement with the City of Bainbridge Island to sample 19 sites along the shoreline of Bainbridge Island. As part of these agreements, DNR sampled the entire shoreline of Bainbridge Island and a large section of eastern Kitsap Peninsula.

Between 2014 and 2016, DNR sampled 190 sites along the shoreline of eastern Kitsap Peninsula and Bainbridge Island (referred to as the East Kitsap Study Area in this report). This is 59 sites more than originally planned, as a larger number of sites could be sampled due to logistical efficiencies. Nine additional sites have been sampled as part of DNR’s Submerged Vegetation Monitoring Program (although some of these sites date from before 2014). This report summarizes sampling methods and eelgrass area and depth results for all sites sampled as part of these projects.

2 Methods

Field sampling was conducted using the methods of DNR's Submerged Vegetation Monitoring Program (SVMP). The SVMP is a regional monitoring program, initiated in 2000, designed to provide information on both the status and trends in native seagrass area in greater Puget Sound. This program uses towed underwater videography as the main data collection methodology to provide reliable estimates of eelgrass area for subtidal seagrass beds in places where airborne remote sensing cannot detect the deep edge of the bed. Video data is collected along transects that are oriented perpendicular to shore and span the area where native seagrasses (mainly eelgrass, *Zostera marina*) grow at a site. The video is later reviewed and each transect segment of nominal one-meter length (and one meter width) is classified with respect to the presence of *Zostera marina* and *Zostera japonica*.

2.1 Study area description

The East Kitsap Study Area is a subset of the SVMP study area, containing 208 sites. A total of 190 sites were sampled as part of IAA 15-17 (amended) between DNR and the Suquamish Tribe, and IAA 16-239 between DNR and the City of Bainbridge Island. Nine additional sites were sampled as part of the SVMP. We divided the study area into 5 different zones (Figure 1): Upper Kitsap (UK), Eastern Bainbridge Island (EB), Port Orchard and Sinclair Inlet (PO), Dyes Inlet and Liberty Bay (INL) and Lower Kitsap (LK). Sites are labeled according to the SVMP dataset. Each code starts with 3 letters (cps, which stands for Central Puget Sound), followed by 4 numbers. The sole exception are the tidal flats, which are coded as "flats" followed by 2 numbers. Figure 1 shows an overview of the study area, divided into the 5 zones. Figures 2 and 3 indicate which project sampled each site in the East Kitsap Study Area. Figures 24 to 28 in Appendix 2 relate the site code with the location of sites.

2.2 Field sampling

2.2.1 Equipment

Field sampling was conducted in September and October 2014 and 2016 from the 36ft research vessel *R/V* Brendan D II (Figure 4). The *R/V* Brendan D II was equipped with an underwater video camera mounted in a downward-looking orientation on a weighted towfish (Figure 5).

Parallel lasers mounted 10 cm apart created two red dots in the video images for scaling reference. The towfish was deployed directly off the stern of the vessel using an A-frame cargo boom and hydraulic winch. The weight of the towfish positions the camera directly beneath a DGPS antenna, ensuring that the data accurately reflected the geographic location of the camera (Figure 5). Time, differential global positioning system (DGPS) data, Garmin and BioSonics depth data were acquired simultaneously during sampling. Differential corrections were received from the United States Coast Guard public DGPS network using the WGS 84 datum. Table 1 lists the equipment used to conduct the video sampling and acquisition of eelgrass depth data.

Table 1: Equipment and software used to collect underwater video and depth data

Equipment	Manufacturer/Model
Differential GPS	Trimble AgGPS 132 (sub-meter accuracy)
Depth Sounders	BioSonics DE 4000 and BioSonics MX Habitat Echosounder
Underwater Cameras	SplashCam Deep Blue Pro Color (Ocean Systems, Inc.)
Lasers	Deep Sea Power & Light
Underwater Light	Deep Sea Power & Light RiteLite (500 watt)
Navigation Software	Hypack Max
Video Overlay Controller	Intuitive Circuits TimeFrame
DVD Recorder	Sony RDR-GX7
Digital Video Recorder	Atomos DV Recorder Datavideo DN-700 / DV Hard Disk Recorder

2.2.2 Site and sample polygons

Prior to field sampling, a site polygon was defined for each site, bounded by the -6.1 m MLLW bathymetry contour and the ordinary high water mark as described in the SVMP methods (Berry et al. 2003, Figure 3). Fringe sites are 1000 m along the -6.1 m contour on the deep edge, while the segment lengths vary for flats sites (e.g., depending on embayment size). In addition, we delineated sample polygons, which encompass all the eelgrass at a site, prior to sampling. At each site, underwater videography was used to sample the presence of eelgrass along transects in a modified line-intercept technique (Norris et al. 1997). Video transects are oriented perpendicular to shore, and extend beyond the shallow and deep edges of the sample polygons. At the majority of sites, transects were selected based on a stratified random approach with 1 transect per stratum (STR). These transects are delineated by dividing the site along the centerline in segments of equal length, and then selecting a random transect perpendicular to shore in each of these segments (Figure 6). In addition, we repeated transects at 15 sites that were sampled in previous years (based on a simple random sample scheme, SRS), to look for changes over time[1]. Sites where reconnaissance indicated that there was no appreciable eelgrass present (30 sites, mostly within Dyes Inlet) were sampled with meander transects only (Figure 6).

[1] Note that most sites with SRS repeat transects were also sampled with STR. We report the results based on STR transects in Table 3.

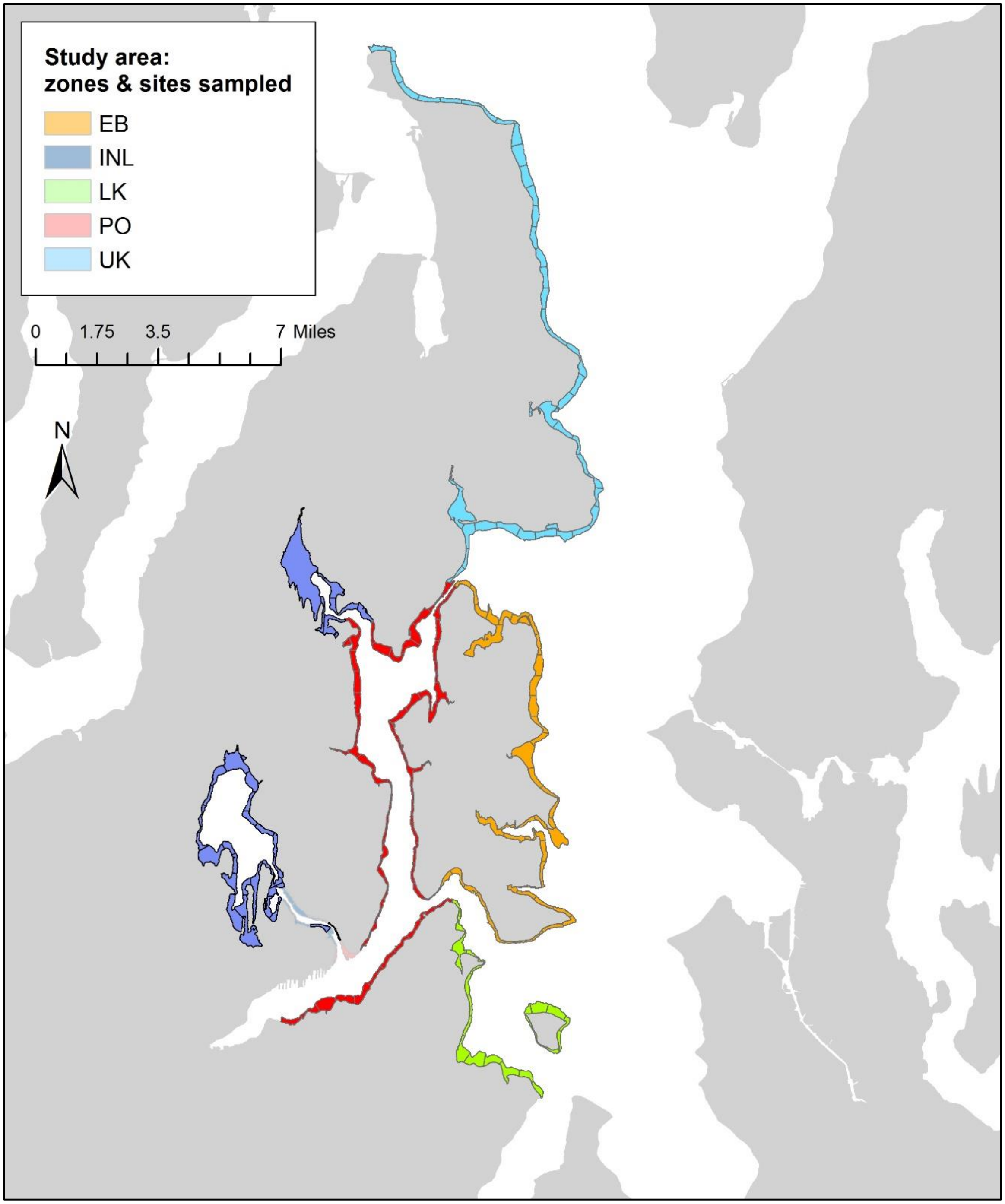

Figure 1: Overview of the East Kitsap Study Area. Zones are indicated by different colors: EB is East Bainbridge Island, INL is Liberty Bay and Dyes Inlet, LK is the Lower Kitsap Peninsula, PO is Port Orchard and Sinclair Inlet, and UK stands for Upper Kitsap Peninsula.

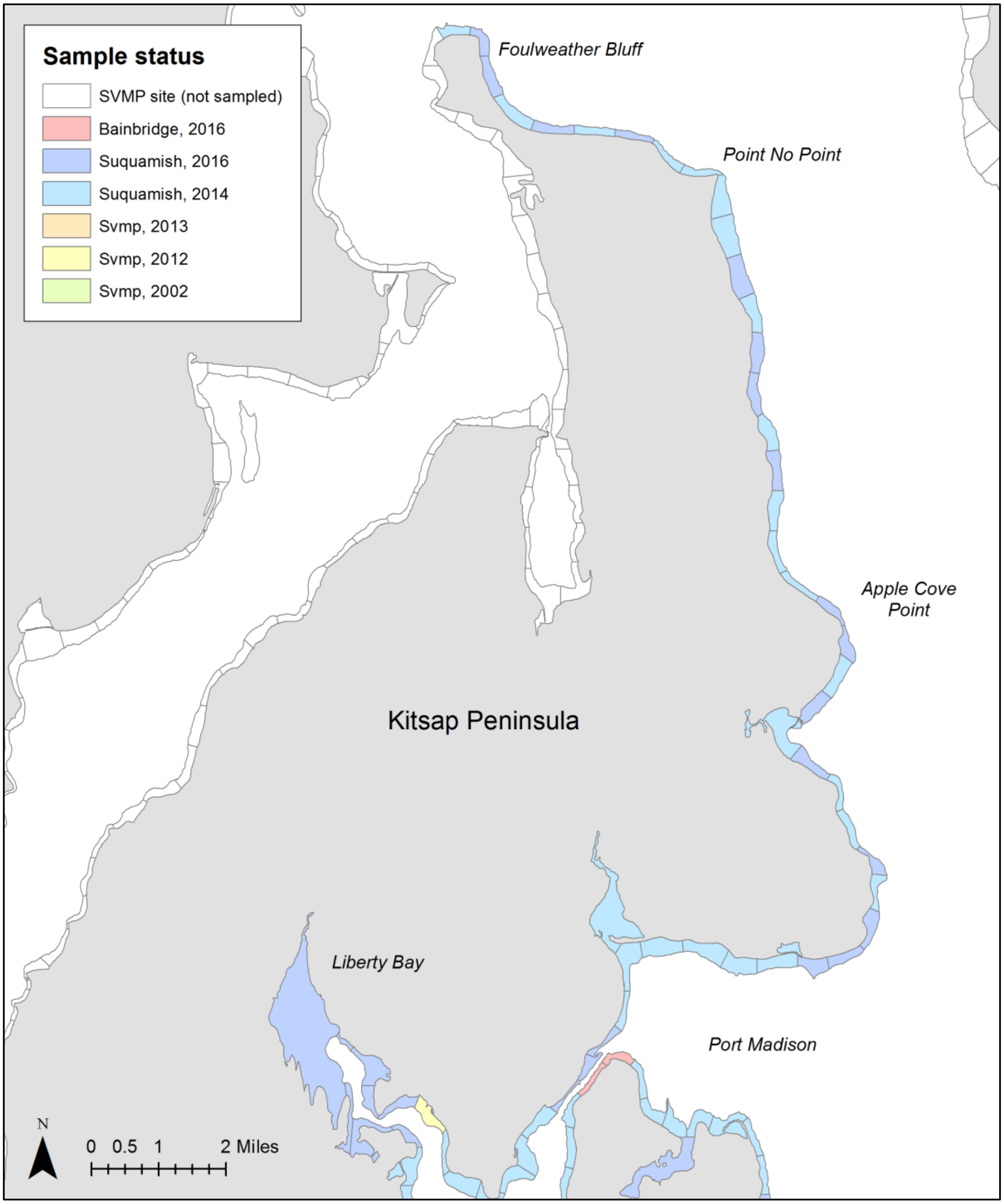

Figure 2: Detail of sample status for the northern part of the East Kitsap Study Area. Colors indicate sites sampled as part of different projects.

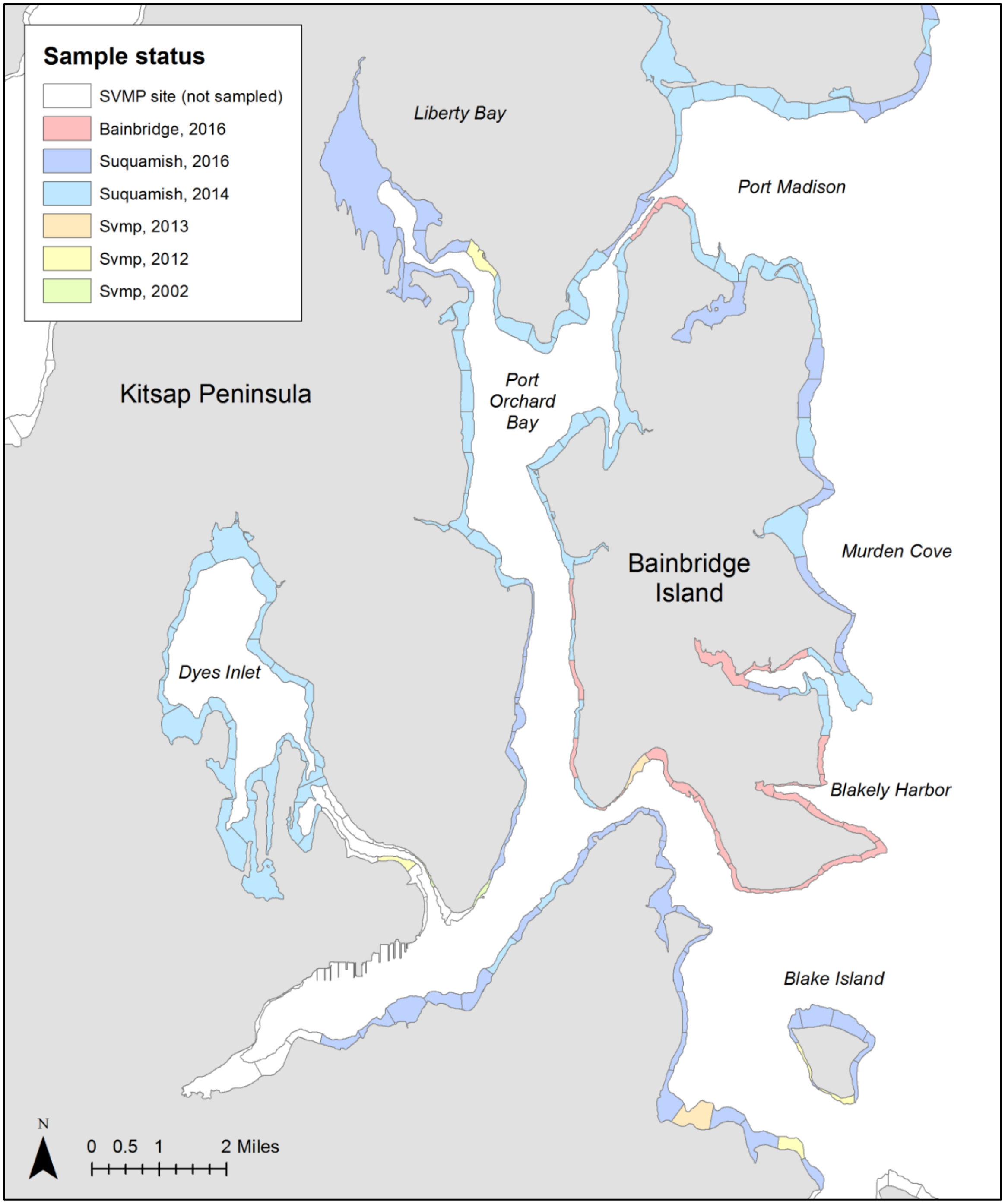

Figure 3: Detail of sample status for the southern part of the East Kitsap Study Area. Colors indicate sites sampled as part of different projects.

Figure 4: Eelgrass presence and depth distribution data were collected from the *R/V* Brendan D II using underwater videography and depth sounding instrumentation.

Figure 5: The *R/V* Brendan D II is equipped with a weighted towfish that contains an underwater video camera mounted in a downward looking orientation, dual lasers for scaling reference, and underwater lights for night work (A). The towfish is deployed directly beneath the DGPS antenna attached to the A-frame cargo boom, ensuring accurate geographic location of the camera (B).

2.3 Video processing and data analysis

2.3.1 Video processing

The video sampling resolution is nominally one square meter and eelgrass is categorized as present or absent based on the observation of rooted shoots within the video field of view. All eelgrass presence and absence classification results were recorded with corresponding spatial information. The fractional presence of eelgrass along transects was used to calculate site eelgrass area. The depth at which eelgrass grows along each transect was used to estimate the depth distribution of eelgrass relative to Mean Lower Low Water (MLLW) within each sample polygon at each site.

All measured depths were corrected to the MLLW datum by adding the transducer offset, subtracting the predicted tidal height for the site and adding the tide prediction error (calculated using measured tide data from the National Oceanic and Atmospheric Administration website http://co-ops.nos.noaa.gov/data_res.html). These final corrected depth data were merged with eelgrass data and spatial information into a site database so the eelgrass observations had associated date/time, position and depth measurements corrected to MLLW datum.

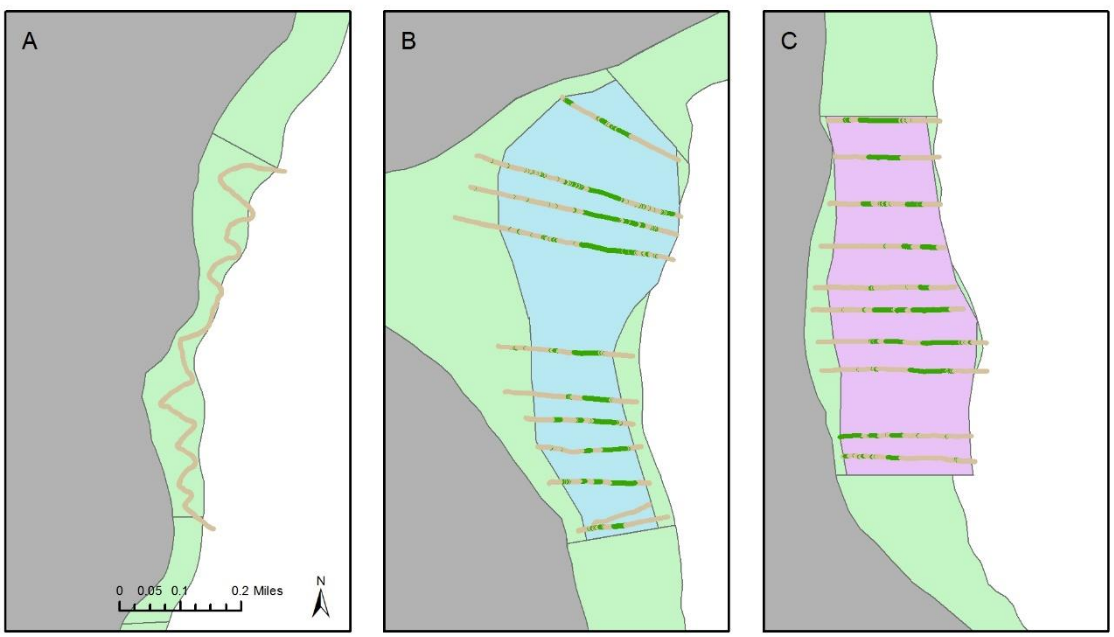

Figure 6: Different transect types: A. Meander transect at cps1106; B. Simple random transects at cps1069; C. stratified random transects with one unit per stratum at cps 1066. Green sections along transects indicate where eelgrass was present. The blue and purple polygons delineate the sample polygons at the sites.

2.3.2 Depth distribution

Minimum and maximum eelgrass depth characteristics for each site were estimated using descriptive statistics (i.e., minimum, maximum, and the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th} and 95^{th} quantiles) for all eelgrass observations along SRS and STR transects. For each site with eelgrass present, we represented the depth distribution with a histogram of depths of all sample points where eelgrass was detected at the site.

The regional depth distribution of eelgrass was calculated as follows. For each site, eelgrass observations were binned according to their depth relative to MLLW in 0.5m bins. The number of observations in each depth bin was divided by the total number of eelgrass observations at the site. This fraction was multiplied by the estimated eelgrass area at the site to estimate the area of eelgrass in each depth bin at the site. We used the following formula to estimate eelgrass area in each depth bin at each site:

$$a_{jk} = A_j \frac{c_{jk}}{\sum_{k=1}^{n} c_{jk}}$$

Where a_{jk} is eelgrass area in each histogram bin (k) at site (j), c_{jk} is the count of observations per bin, and A_j is estimated eelgrass area at site j. Per-bin area estimates from sites were combined into a depth distribution for the entire study area.

Since we do not have area estimates for *Zostera japonica*, we plotted the fraction of total observations per depth bin for *Zostera japonica* and *Zostera marina* for the entire study area to illustrate the difference in depth distributions between both species.

2.3.3 Area calculation

Eelgrass area at each site was calculated using ArcGIS software and the site database file in the following sequential steps:

1. Calculate the area within the sample polygon;
2. Calculate the fraction of eelgrass along each random line transect;
3. Calculate the mean fraction and associated variance[2], weighed by transect length;
4. Estimate the overall eelgrass area and variance at the site by extrapolating the mean fraction along random transects over the sample polygon area.

Because we comprehensively surveyed the study area, we estimate the total eelgrass area per zone by adding all the site eelgrass area estimates. Uncertainty was estimated using the methods employed for the core stratum in the area calculations for the Submerged Vegetation Monitoring Program. For more information on the statistical framework and the sample methods in general, see Berry et al. (2003) and the QAPP submitted for this project (Gaeckle 2014).

[2] We calculate variance for stratified random samples using the textbook variance estimator. This formula may overestimate actual variance for stratified random samples and systematic samples, and is thus a conservative estimator of variance for these sampling schemes (McGarvey et al. 2016).

2.3.4 Trend analysis

Fifteen sites in the East Kitsap Study Area were sampled in previous years. At these sites, the original SRS transects were re-sampled and the difference in vegetated fraction was used as input for paired t-tests weighted by transect length (function wtd.t.test from the package ‘weights’ in R). Before data analysis, transect pairs were clipped using the same sample polygon. We test the quality of the repeats by comparing the total length of the paired transects. If transect length was different by more than 10%, the transect pair was removed from analysis. At two sites (cps1066 and cps2215), it was difficult to distinguish the deep edge of intertidal *Zostera japonica.* At these locations we used total seagrass cover along transects (both *Zostera marina* and *Zostera japonica*) as input for the analysis. At cps1069, not enough paired transects remained after the quality control step of removing transects that differed by more than 10% in total length. The eelgrass bed at this location was classified as increasing based on the site area estimates in 2010 and 2014. At cps1035 there was no eelgrass left along the SRS transects in 2016. This site was labeled declining. However, as small amount of eelgrass remains outside of the sampled SRS transects.

3 Results

3.1 Seagrass species in the East Kitsap Study Area

There are two species of seagrass in the East Kitsap Study Area: *Zostera marina* and the non-native *Zostera japonica* (Figure 7). Out of the 199 sites sampled along the shoreline of the study area, there were 118 sites with *Zostera marina* (eelgrass), 58 sites with the non-native *Z. japonica*, and 77 sites where seagrass was absent. *Zostera marina* is widespread along the eastern shoreline of the Kitsap Peninsula and Bainbridge Island, but its distribution is more limited near Port Orchard. Eelgrass was present at all sites along the upper Kitsap Peninsula, at 80% of all sites on East Bainbridge and on the Lower Kitsap Peninsula, and at 39% of sites in Port Orchard (Figure 8). Eelgrass is sparse to absent in enclosed embayments such as Blakely Harbor (cps1085), Eagle Harbor (flats36), Manzanita Bay (cps1050), and the inside of Port Madison Bay (flats38). There is no eelgrass in Liberty Bay, and only a trace amount in Dyes Inlet (Figures 9 and 10). Note that while there is a trace amount of eelgrass at the mouth of flats38, the site has been indicated as eelgrass absent on figure 10 to better represent the spatial distribution of eelgrass at this location.

Figure 7: A small patch of non-native *Zostera japonica*, surrounded by the native *Zostera marina*. *Z. japonica* is usually smaller than *Z. marina*, but at some locations it is difficult to differentiate between both species based on size. Other defining characteristics include the morphology of the leaf sheath and the root system.

The non-native *Zostera japonica* is generally a lot smaller than *Zostera marina* (Figure 7). *Zostera marina* is morphologically very plastic, and its leaves can vary from 10-20cm to well over 1.5m long. As such, it can be difficult to distinguish both species based on size alone. DNR classifies presence/absence *of Zostera japonica* from video observations, but at sites where we suspect this species to be present, we usually take a number of grab samples to confirm our observations based on the morphology of the leaf sheath.

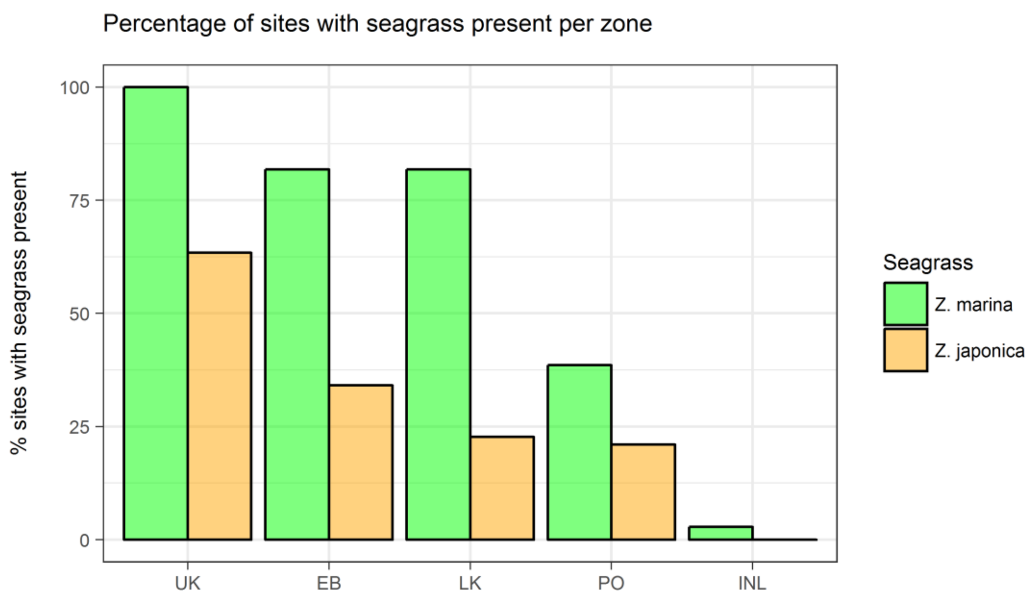

Figure 8: Percentage of all sites with *Zostera marina* and *Zostera japonica* in the different zones of the East Kitsap Study Area.

Zostera japonica grows at higher tidal elevations than *Z. marina*, and is often too shallow for the sample vessel. As such, our data are conservative estimates for the presence/absence of *Z. japonica*. Nevertheless, the data suggests that *Z. japonica* is common on the shores of East Kitsap Peninsula and Bainbridge Island. *Zostera japonica* is most prevalent on the shores of the Upper Kitsap Peninsula, and becomes less prevalent towards Eastern Bainbridge, Lower Kitsap and Port Orchard (Figure 8). There is no *Zostera japonica* in Liberty Bay and Dyes Inlet. *Z. japonica* usually occurs at sites where *Z. marina* is present. Only 4 of the 199 sites sampled contained only *Z. japonica* but no *Z. marina* (Figures 9 and 10). This suggests that both species have very similar requirements in terms of habitat and substrate. While it was not possible to provide an accurate estimate of *Z. japonica* area due to sampling restrictions, the maps in appendix 3 indicate that *Zostera marina* is far more abundant than *Zostera japonica* at sites where both species are present.

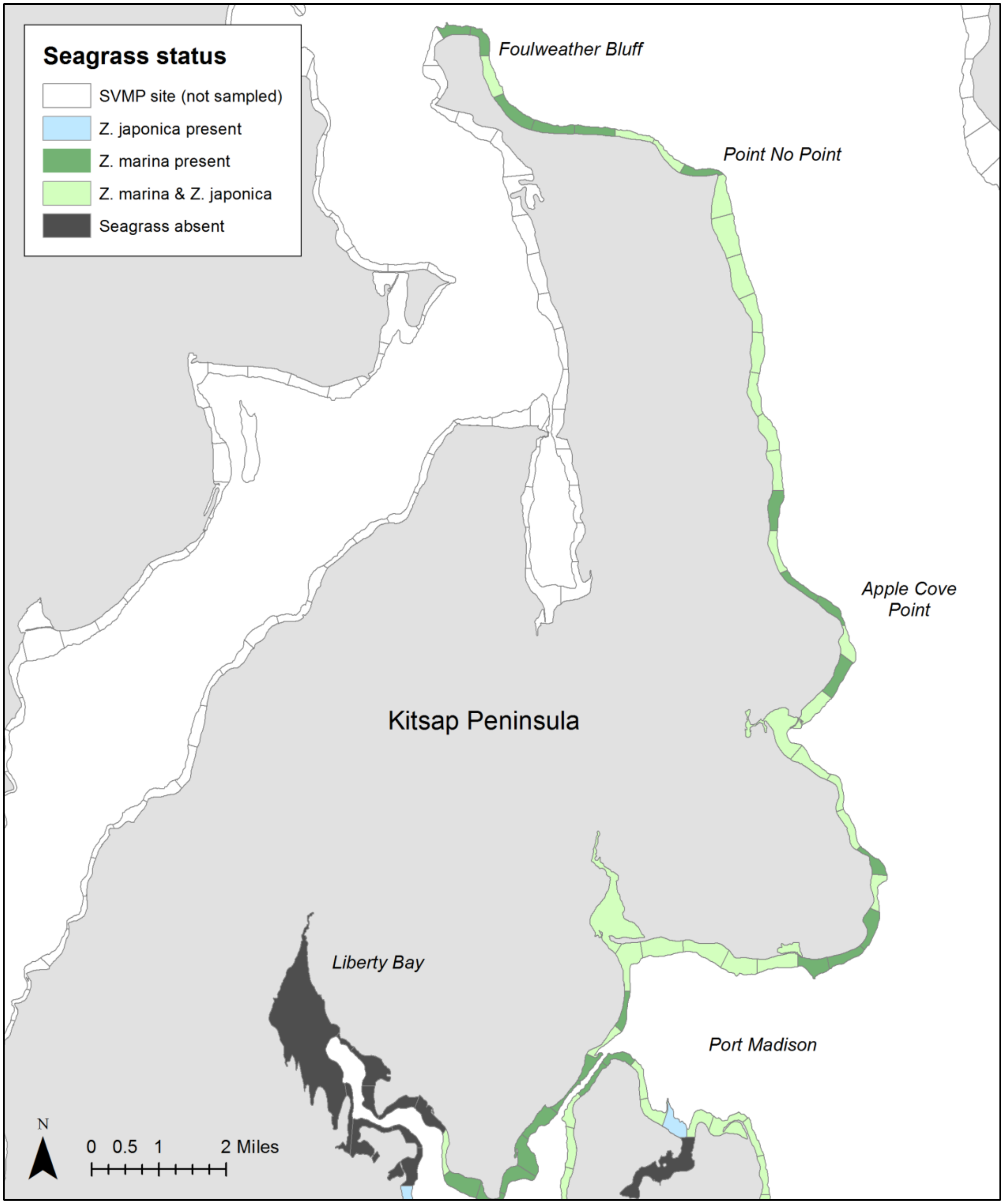

Figure 9: Seagrass status in the northern part of the East Kitsap Study Area.

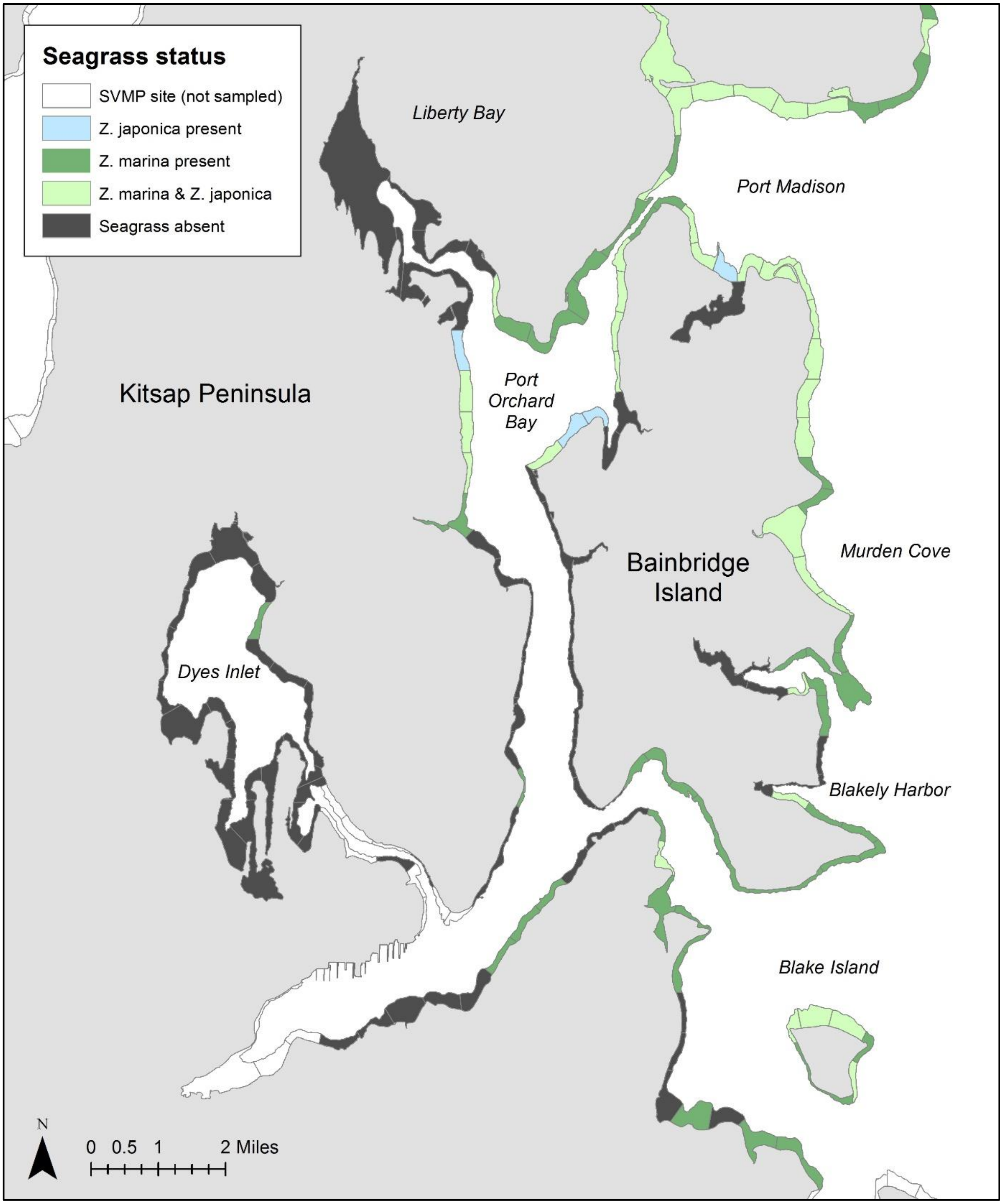

Figure 10: Seagrass status in the southern part of the East Kitsap Study Area.

3.2 Area estimates of eelgrass beds in the East Kitsap Study Area

The eelgrass beds along the shoreline of the East Kitsap Study Area are relatively small. This is to be expected, as most of these beds grow on relatively narrow fringes of shoreline. Out of the 118 sites with eelgrass**,** 33 sites have less than 1 ha of eelgrass present, 37 sites have between 1 and 5 ha of eelgrass present, 23 sites have between 5 and 10 ha present, 19 sites have between 10 and 15 ha present, and only 6 sites have eelgrass beds larger than 15 ha. As such, the distribution of eelgrass area in the East Kitsap Study Area is skewed (Figure 11). The sites with the largest eelgrass beds are cps2220, cps2228, cps2227 and cps2219; with 22.83 ± 0.78 ha, 18.42 ± 0.96 ha, 18.13 ± 0.74 ha, and 16.48 ± 0.97 ha respectively. Overall, sites on the east side of Bainbridge Island and along the northeastern shores of Kitsap Peninsula have larger eelgrass beds than sites in Dyes Inlet, Sinclair Inlet or Port Orchard.

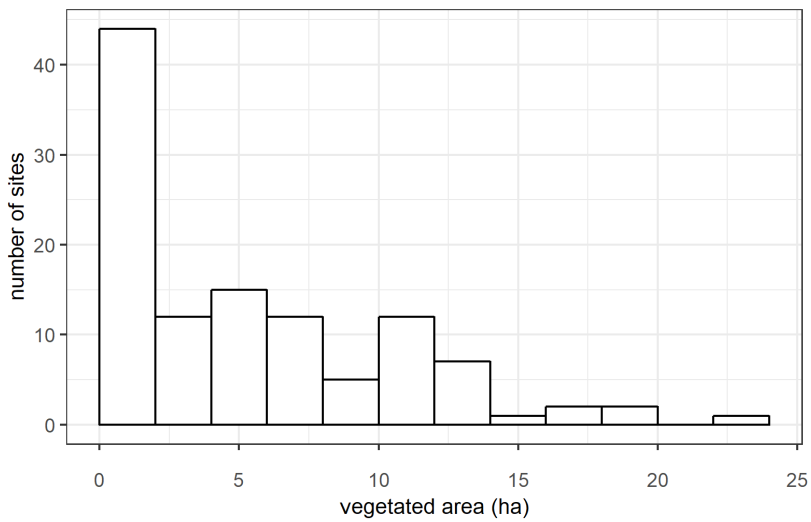

Figure 11: The size distribution of eelgrass beds at sites in the East Kitsap Study Area (ha). The majority of eelgrass beds in the study area is relatively small (< 10 ha).

We divided the East Kitsap Study Area into 5 zones and estimated total eelgrass area in each of these zones based on the current sample of 199 sites (Figure 12). Given that we sampled the vast majority of sites within the study area, the degree of uncertainty associated with the estimates is relatively small, which is represented by the error bars in Figure 12. The northeastern part of the Kitsap Peninsula (UK) and the eastern part of Bainbridge Island (EB) have the greatest eelgrass area. Eelgrass is less prevalent within Port Orchard Bay (PO), and is almost completely absent within Dyes Inlet and Liberty Bay (INL). The lower part of the Kitsap Peninsula (zone LK) has a similar eelgrass area as Port Orchard. However, the geographic area of zone LK is a lot smaller than PO, indicating that the relative abundance of eelgrass is much higher in LK than in PO (Figure 13). The median size of eelgrass beds in the East Kitsap Study Area is approximately 3.36 ha (range 0.001 – 22.83 ha). This is very similar to fringe sites throughout greater Puget Sound (median size 3.5 ha, range 0.001 – 75 ha). Based on the site estimates, there is approximately 598 ha of eelgrass on the shores of the East Kitsap Study Area (as compared to ~23,000 ha in the entire greater Puget Sound area).

The zone with the largest amount of potential substrate (INL) has the least amount of eelgrass present (Figure 13).

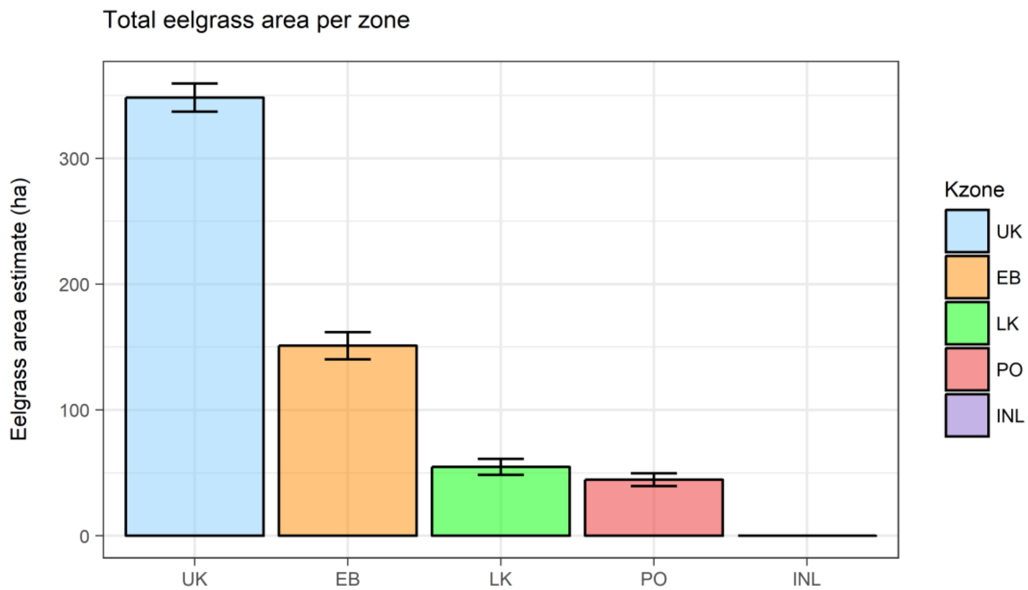

Figure 12: Estimates of total eelgrass area (ha) in 5 zones of the East Kitsap Study Area. The error bars are 95% confidence intervals. Note: A trace amount of eelgrass was observed at one site in Dyes Inlet.

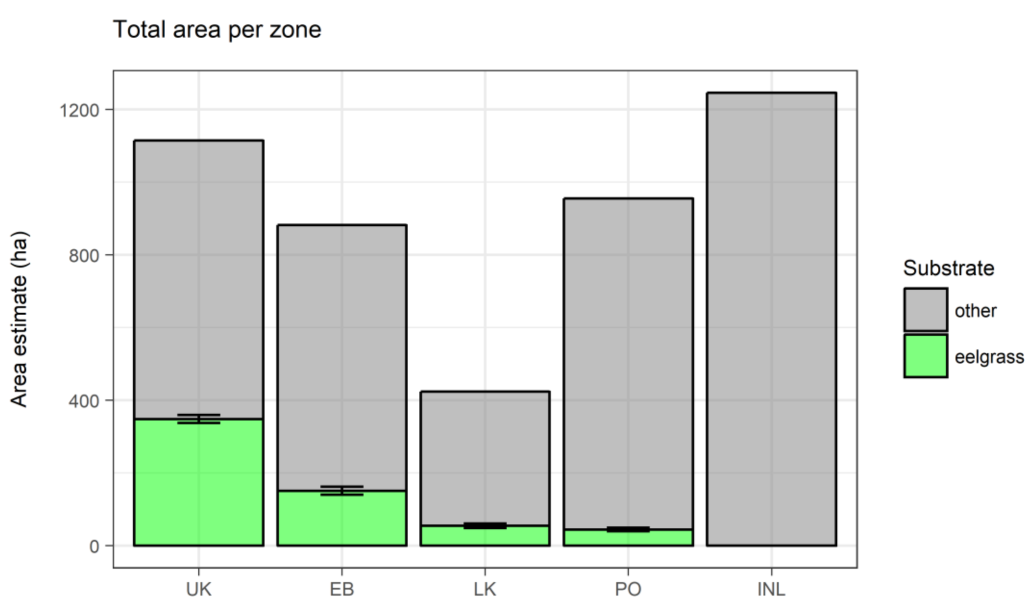

Figure 13: Estimates of total eelgrass area (ha) relative to total available substrate in each of the 5 zones, calculated as the sum of the areas of all SVMP site polygons per zone. The SVMP site polygons stretch from the high water mark to -6.1 m relative to MLLW.

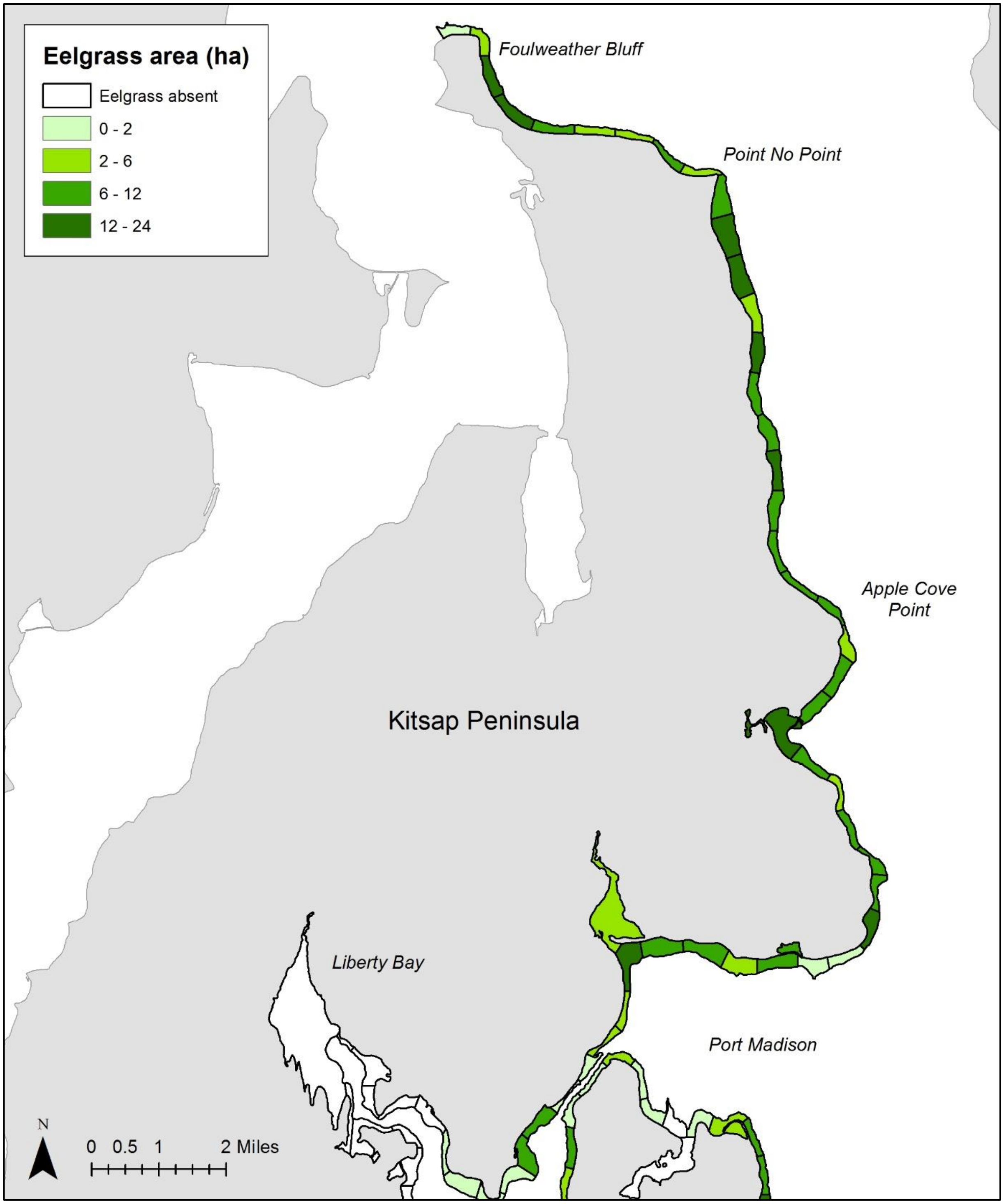

Figure 14: Size of eelgrass beds in the northern part of the East Kitsap Study Area. Darker green colors indicate sites with larger eelgrass beds.

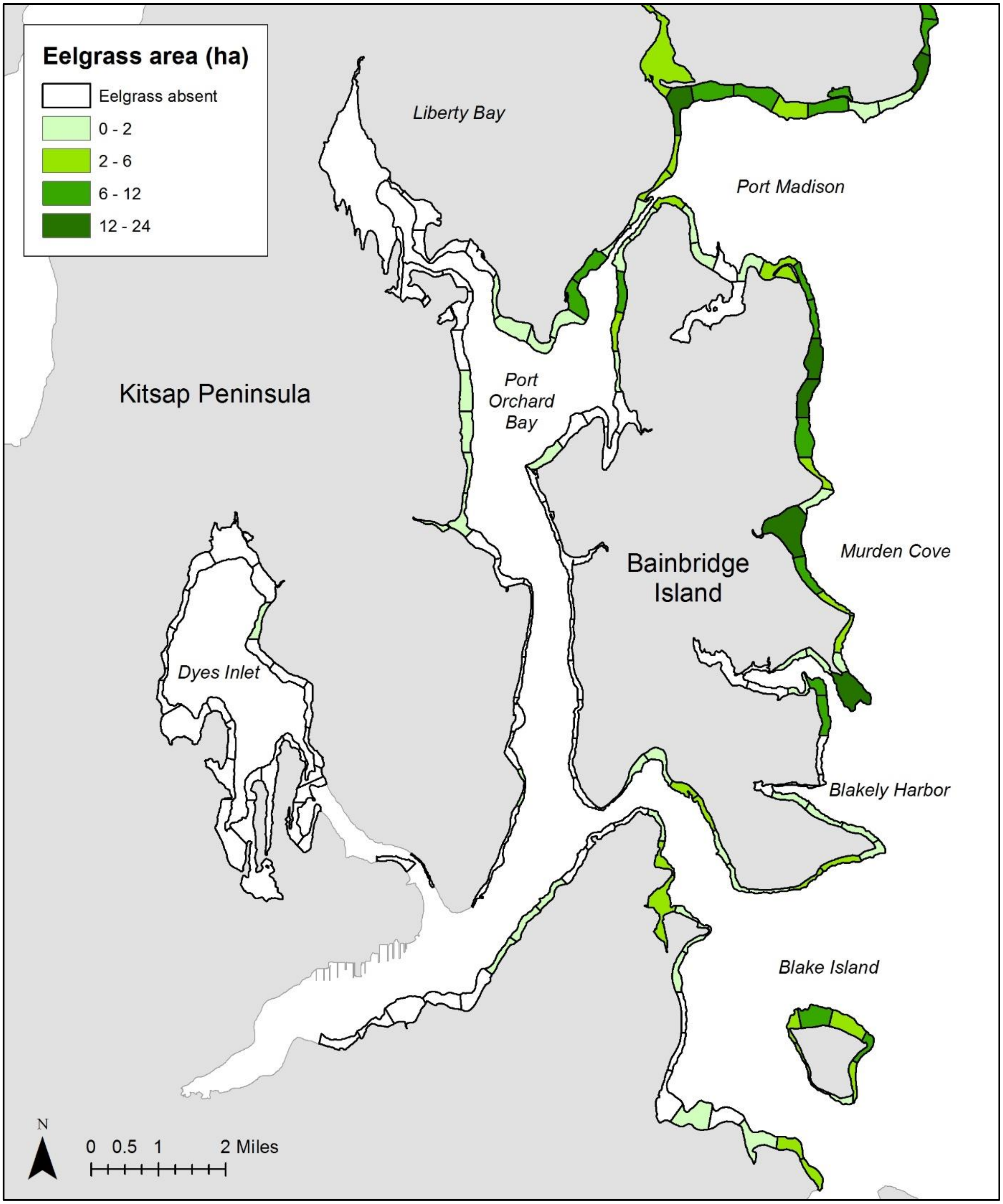

Figure 15: Size of eelgrass beds in the southern part of the East Kitsap Study Area. Darker green colors indicate sites with larger eelgrass beds.

3.3 Depth range of eelgrass beds in the East Kitsap Study Area

Table 3 in Appendix 1 summarizes the depth distribution of eelgrass at individual sites based on our observations. Sites cps1101 and cps1035 are not included, since we have insufficient data to generate a depth distribution for these sites (trace eelgrass). Eelgrass grows between -12.5 and 1.3m relative to MLLW. At the majority of sites, the deepest eelgrass observations are shallower than -8m relative to MLLW (Figure 16). While the deepest observation of eelgrass conveys some information of the distribution of eelgrass at a site, it is generally not a good representation of the deep edge of eelgrass beds at a location. Instead, we calculated the deep edge of eelgrass beds as the 5th percentile of eelgrass depth observations at individual sites (q05 in Table 3). These values are generally between -1.5 and -5m relative to MLLW (Figure 16).

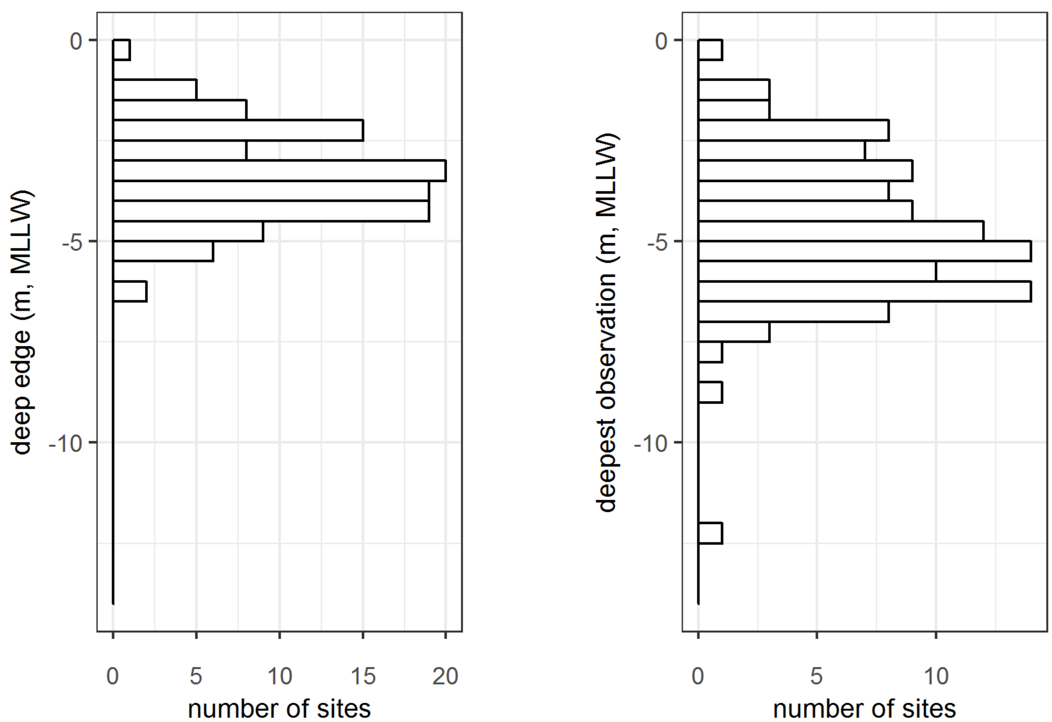

Figure 16: Distribution of the deep edge and deepest observation for all sites with eelgrass in the East Kitsap Study Area.

Figures 17 and 18 show the spatial distribution of the deep edge of eelgrass beds throughout the East Kitsap Study Area. Sites within small embayments (Appletree Cove, Miller Bay, Eagle Harbor, and Blakely Harbor) tend to have eelgrass beds that do not extend as deep as nearby sites. Eelgrass beds have shallower deep edges in Port Orchard Bay and Sinclair Inlet as compared to sites on the eastern shore of Bainbridge Island and the northeastern shores of Kitsap Peninsula.

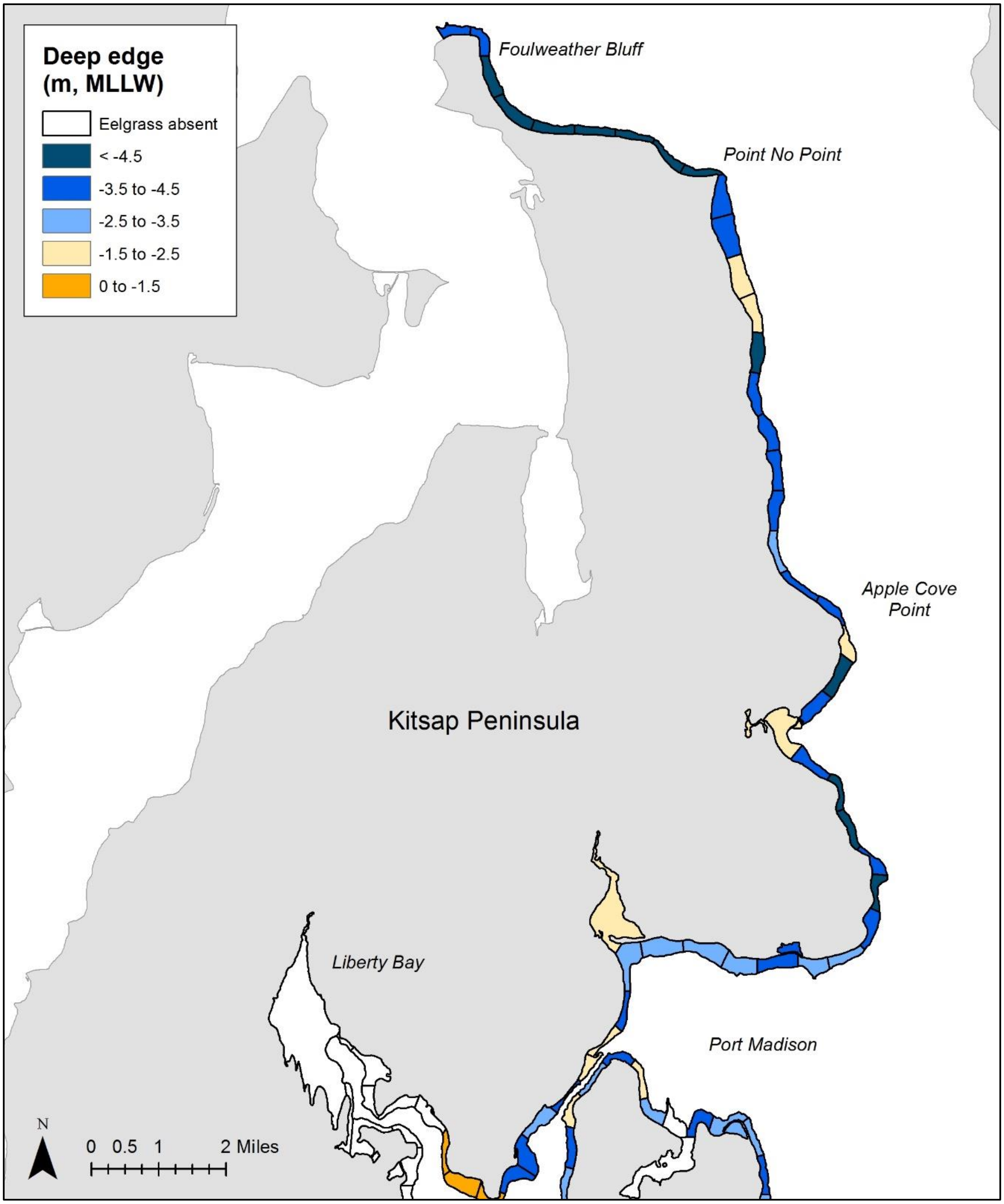

Figure 17: Deep edge of eelgrass beds at sites along the eastern shoreline of the upper Kitsap Peninsula. Sites sampled are outlined in black. The deep edge is calculated as the 5th percentile of all eelgrass depth observations at individual sites.

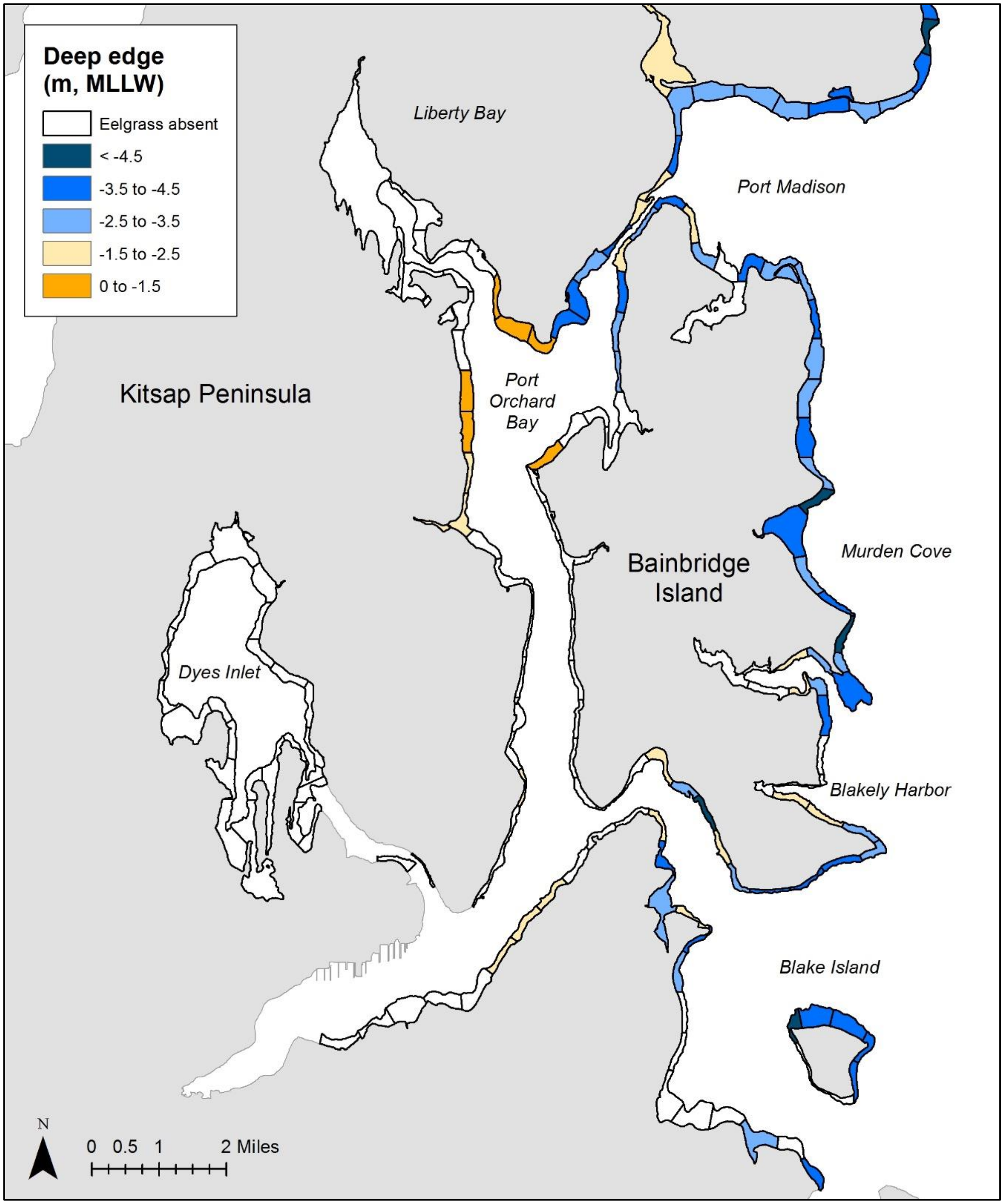

Figure 18: Deep edge of eelgrass beds at sites along the shorelines of Bainbridge Island, Port Orchard Bay, Liberty Bay and Dyes Inlet. Sites sampled are outlined in black. The deep edge is calculated as the 5th percentile of all eelgrass depth observations at individual sites.

Figure 19 shows the depth range where eelgrass grows, calculated as the difference between the 5th and the 95th depth observation for each site in the East Kitsap Study Area, ordered by zone. Eelgrass depth range is mostly determined by the deep edge. Similar to figures 17 and 18, there is high variability in the depth range and the maximum depth at which eelgrass is found among individual sites. Eelgrass tends to grow deepest at sites on the Upper Kitsap Peninsula, East Bainbridge and Lower Kitsap Peninsula. Port Orchard and Sinclair Inlet tend to have eelgrass beds with smaller depth ranges. This is both due to the lower amount of intertidal eelgrass and the shallower maximum eelgrass depth at sites within Port Orchard. The transparent boxes indicate overall shallow and deep edge per zone, calculated as the 5th and 95th percentile of eelgrass area per 10 cm depth bins for each zone. The overall depth range is largest in Upper Kitsap, and smallest in Port Orchard.

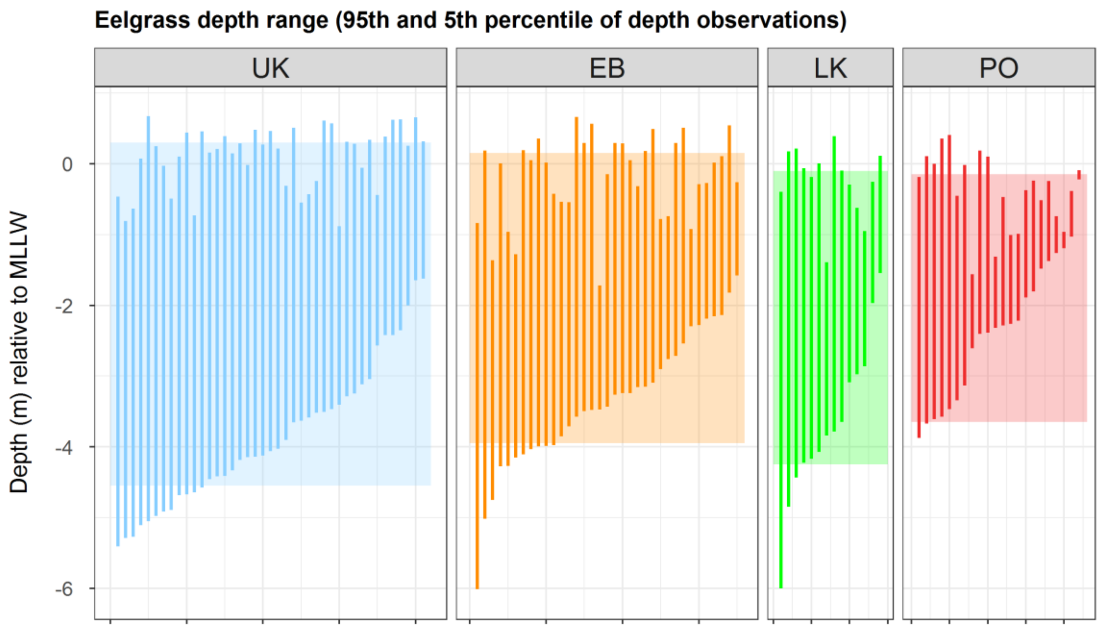

Figure 19: Deep edge, shallow edge and depth range for all sites with seagrass, ordered by deep edge within each zone. The transparent box indicates the overall shallow edge, deep edge and depth range for each of the 4 zones with eelgrass present, calculated as the he 5th and 95th percentile of eelgrass area per 10 cm depth bins for each zone. Data from the INL zone is not represented due to the limited sites with eelgrass present.

There is a non-linear relationship between eelgrass depth range and the size of eelgrass beds in the study area: large eelgrass beds tend to have larger depth ranges than eelgrass beds that are less than 2.5 ha in size (Figure 20). However, this relationship is noisy, especially for smaller eelgrass beds. Small eelgrass beds with large depth ranges are often indicative of eelgrass beds growing on sites with steep bathymetric slopes.

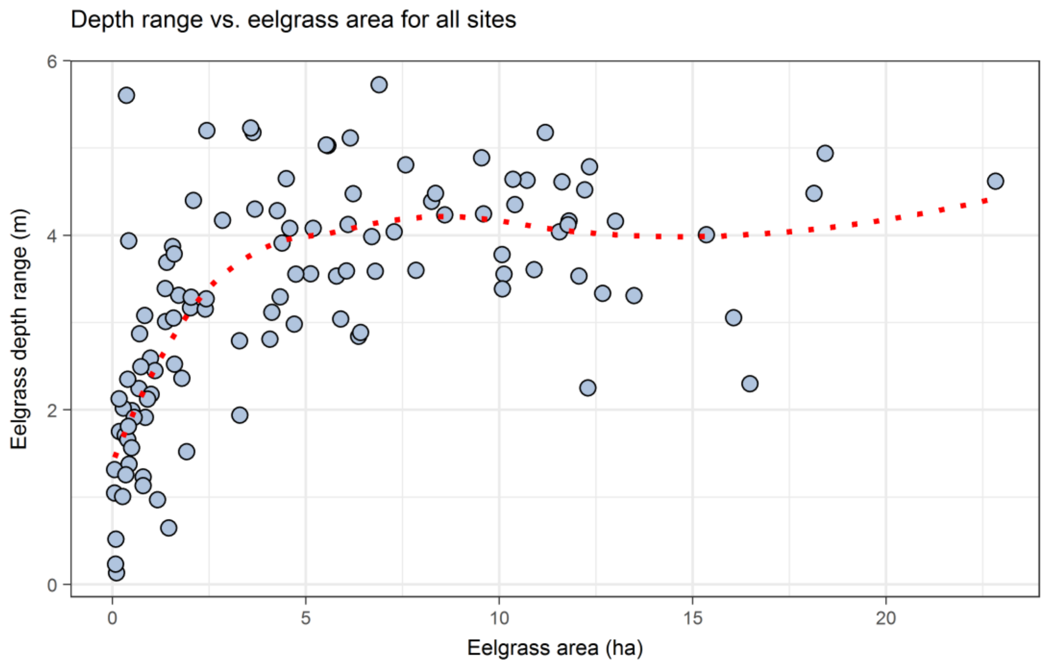

Figure 20: Depth range (m) vs. eelgrass area (ha) for all sites in the East Kitsap Study Area

Figure 21 shows the depth distribution and cumulative depth distribution based on all observations of eelgrass in each of the 4 zones with eelgrass. Approximately 90 % of all eelgrass in the study area grows between 0 and -4.5 m relative to MLLW, but the optimal depth range for eelgrass tends to be more restricted. Approximately half of the eelgrass in the study area grows shallower than -1.5m relative to MLLW (Figure 22).

We classify eelgrass as either intertidal or subtidal, and define the boundary between intertidal and subtidal as -1 m (relative to MLLW), which is a biologically relevant estimate of extreme low tide depth in the Puget Sound region[3]. For more information on this calculation, see Hannam et al. (2015). When comparing to this boundary, approximately 61 % of all eelgrass in the study area grows in the subtidal, while 39 % grows in the intertidal (Figure 22). This is similar to other sites in greater Puget Sound, where approximately 62% of all eelgrass occurs in the subtidal (Hannam et al. 2015). The non-native seagrass *Zostera japonica* is common in the study area and has a different depth distribution as compared to *Zostera marina*. It usually grows shallower, and is able to thrive in the intertidal habitats (Figure 22).

[3] Note that this is different from the Extreme Low Tide Line as estimated by the federal government. See discussion section.

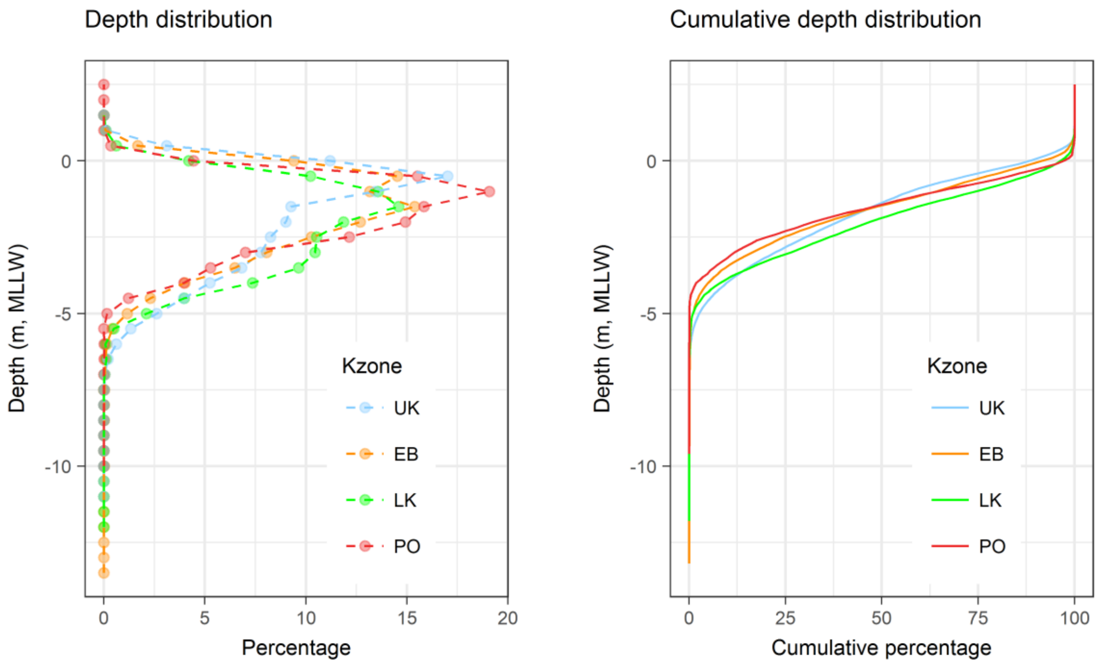

Figure 21: Depth distribution (left) and cumulative depth distribution (right) of eelgrass for each zone with eelgrass in the East Kitsap Study Area.

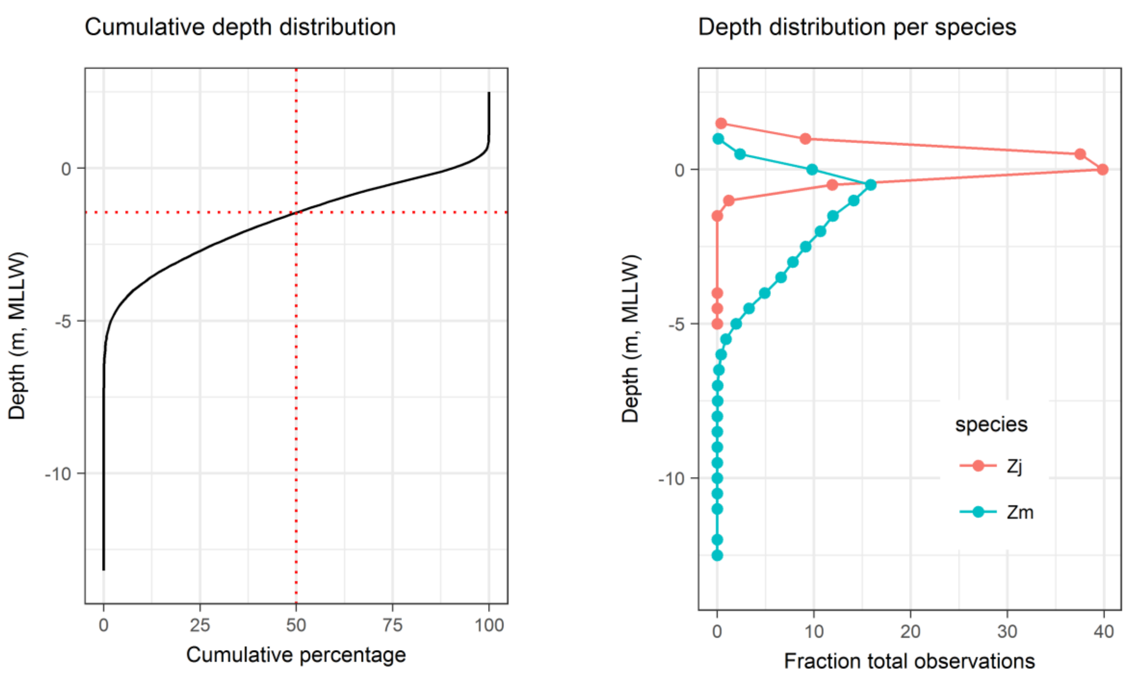

Figure 22: Cumulative depth distribution for the entire East Kitsap Study Area (left). The median depth for eelgrass is -1.45 m (MLLW). Fraction of total observations per depth bin for *Zostera marina* and *Zostera japonica* (right). Note that these fractions have not been adjusted for site area, since we do not have good estimates of site area for *Zostera japonica*.

3.4 Trends in eelgrass area

In 15 out of the 199 sites, we repeated previously sampled SRS transects to assess change over time[4]. Based on the repeat transect analysis, four sites showed increases over time (cps2201, cps2221, cps2218 and cps1069) and 2 sites showed declines (cps1035 and cps2105). It is important to consider that the pairs of samples do not span the same period of time. The time between pairs of samples ranges from 1 to 8 years. There appears to be no clear relationship between the magnitude of the changes in eelgrass area and the number of years before a site was resampled.

At sites cps1066 and cps2215 it was difficult to distinguish between *Zostera marina* and *Zostera japonica*. At these sites we used total vegetation cover along transects (*Zostera marina* and *Zostera japonica*) to estimate change in total seagrass area. We also generated a best estimate for the area covered by eelgrass in 2014, which can be found in Table 3. These sites are indicated with a * in Table 2 and Figure 23. Future monitoring at these sites will require additional ground truthing to assess the extent of *Zostera japonica* throughout the intertidal.

Table 2: Trends in eelgrass area at sites sampled using repeat transects. Out of the 15 sites sampled, there were 4 sites with increases over time, 2 sites with declines, and 9 sites where eelgrass was stable. At cps1066 and cps2215 there is possible misidentification of *Zostera marina* and *Zostera japonica*. For this site we used both species to estimate area.

site_code	Year 1	n	Eelgrass area (ha)	standard error (ha)	Year 2	n	Eelgrass area (ha)	standard error (ha)	Years difference	Trend
cps1035	2009	14	0.11	0.06	2016	12	0	0	7	Decline
cps1046	2010	15	0.05	0.02	2014	13	0.04	0.03	4	Stable
cps1054	2009	13	0.89	0.13	2016	13	0.95	0.12	7	Stable
cps1066	2012	11	16.9	2.51	2014	11	15.2	1.71	2	Stable*
cps1069	2007	11	9.98	0.76	2014	10	13.25	1.16	7	Increase
cps2105	2009	12	0.73	0.32	2016	12	0.07	0.04	7	Decline
cps2201	2007	11	8.42	0.56	2014	11	9.55	0.96	7	Increase
cps2208	2012	12	10.75	0.72	2014	12	11.03	0.71	2	Stable
cps2215	2010	12	8.67	0.95	2014	12	9.47	0.98	4	Stable*
cps2218	2006	12	4.6	0.75	2014	12	6.14	0.44	8	Increase
cps2221	2010	12	7.12	0.39	2014	12	10.6	0.32	4	Increase
cps2223	2013	12	6.3	0.52	2014	12	6.32	0.55	1	Stable
cps2227	2013	11	19.15	0.5	2014	11	19.47	0.45	1	Stable
cps2230	2013	14	0.4	0.14	2014	14	0.45	0.15	1	Stable
flats37	2006	11	13.99	4.87	2014	11	15.83	5.38	8	Stable

[4] Thirteen of these sites were sampled with both SRS and STR transects in 2014/2016. The eelgrass area estimates based on SRS transects are shown in Table 2. The eelgrass area estimates based on the STR samples are shown in Table 3, Appendix 1.

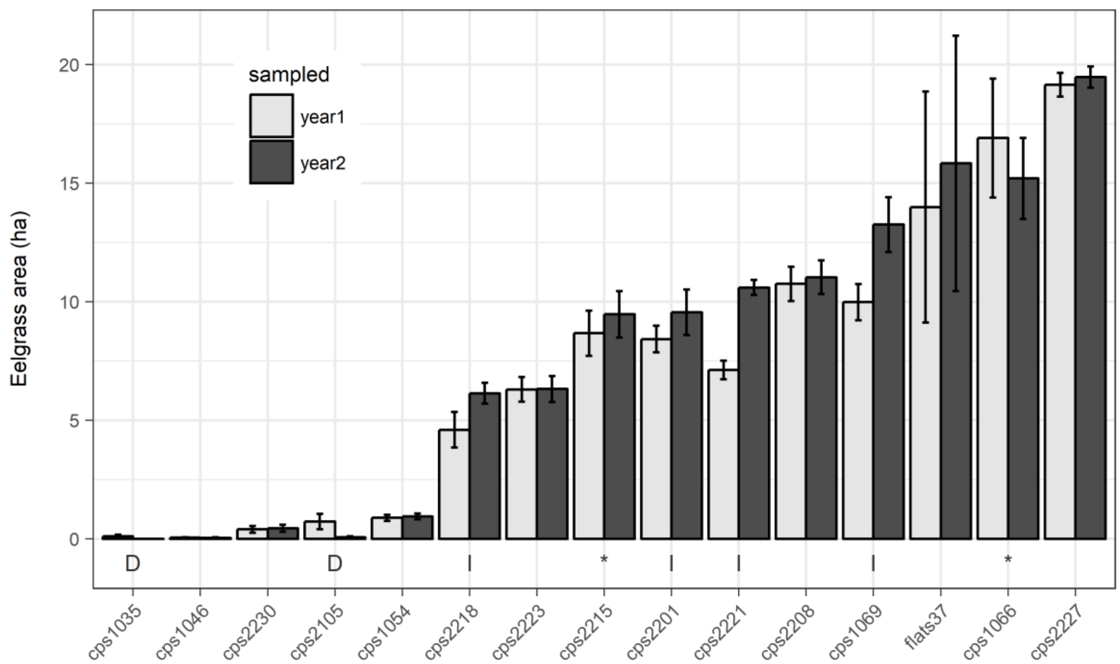

Figure 23: Change in eelgrass area over time at 15 sites sampled with repeat transects. The time between years ranges from 1 to 8 years for different sites. Sites with declines are indicated with the letter D and sites with increases are indicated with I. At cps2215 and cps1066 we used total vegetated area, based on both *Zostera marina* and *Zostera japonica* cover along transects. These sites are indicated with *.

4 Discussion

4.1 Eelgrass area in the East Kitsap Study Area

Based on the site area estimates, we estimate that there is approximately 598 ha of eelgrass in the East Kitsap Study Area. This is roughly 18.5% of the current best estimate for eelgrass area in Central Puget Sound, and less than 3 % of all eelgrass in greater Puget Sound (Christiaen et al., 2016). The majority of eelgrass in the study area grows along narrow fringes of intertidal and subtidal land along the shoreline. This is very similar to other eelgrass habitat in Central Puget Sound, where more than 90 % of eelgrass grows on fringe sites. It contrasts with the soundwide distribution pattern, where approximately 50% of eelgrass grows on flats sites.

The zone with the largest amount of eelgrass is the upper Kitsap Peninsula (~348 ha), followed by East Bainbridge (~151 ha), lower Kitsap (~55 ha) and Port Orchard (~44 ha). There are only trace amounts of eelgrass in Dyes Inlet, and eelgrass is completely lacking from Liberty Bay. The pattern is similar when eelgrass area is compared to the amount of available substrate (estimated by sum of the area of each site polygon). Eelgrass covers approximately 30% of all substrate in the depth band between the high water mark and -6.1m relative to MLLW in Upper Kitsap, 17% in East Bainbridge, 13% in Lower Kitsap, less than 5% in Port Orchard and practically 0% in Dyes Inlet and Liberty Bay. Several factors could explain this pattern. Eelgrass requires a suitable substrate and is restricted to a certain depth band due to light limitation and exposure at low tide. Several sites in the mid- and lower parts of Port Orchard have narrow steep shorelines, which may not be conducive for eelgrass growth. Terminal inlets and enclosed embayments, such as Dyes Inlet and Liberty Bay, can have longer water residence times, and are more susceptible to lower water quality.

At the majority of sites surveyed, eelgrass beds were relatively small (between 0 and 25 ha per 1000 m of shoreline). Small seagrass beds at fringe sites may provide different ecosystem services than contiguous seagrass beds growing on large flats sites. Large contiguous seagrass beds tend to have more stable nekton communities over time, as they provide enough habitat to sustain a wide variety of species (Hensgen et al., 2014), while smaller eelgrass beds on fringe sites are important for habitat connectivity. Small narrow seagrass beds also tend to be more dynamic than larger beds, as they are more vulnerable to disturbance from hydrodynamic forces (Koch 2001, Greve and Krause-Jensen 2005), and have a lower ability to recruit new shoots through both sexual and asexual reproduction (Greve and Krause-Jensen 2005).

4.2 Eelgrass depth limits in the East Kitsap Study Area

In the study area, eelgrass is found at depths between -12.5 and 1.3 m relative to Mean Lower Low Water (MLLW). However, the vast majority (90%) of plants is found between 0 and -4.5 m (MLLW). The optimal depth range for eelgrass appears to be between 0 and -2.5 m relative to MLLW, as these are the depth bins with the highest percentage of eelgrass present in the eelgrass depth distribution for each of the zones. There is only one site where eelgrass grows deeper than -8.5m (cps1072), and at that location there are only very few plants that extend to this depth. Overall, the depth distribution of eelgrass in the East Kitsap Study Area is very similar to other sites in Central Puget Sound, but more restricted as compared to the San Juan Islands and the Strait of Juan de Fuca (Hannam et al. 2015).

Approximately 61% of all eelgrass grows in the subtidal (deeper than -1 m, MLLW), and roughly 51% of eelgrass grows deeper than the Extreme Low Tide Line[5]. This is very similar to greater Puget Sound as a whole, where approximately 62 % of all eelgrass grows subtidally (Hannam et al. 2015) and 50 % grows deeper than the Extreme Low Tide Line. The depth distribution of eelgrass has implications for the protection of this vulnerable plant. The Extreme Low Tide Line forms the boundary between tidelands and bedlands for a large part of Puget Sound. Virtually all bedlands in Washington are owned by the State, while only 29 % of Washington State's tidelands remain in public ownership (Ivey 2014). This suggests that a large proportion of eelgrass is found on state owned aquatic lands, which emphasizes the importance of continued stewardship activities by DNR.

Eelgrass tends to grow to greater depths along the northeastern Kitsap Peninsula, southeastern Kitsap Peninsula, and the eastern side of Bainbridge Island, as compared to Port Orchard Bay and Sinclair Inlet. Eelgrass essentially disappears when moving further west into Liberty Bay and Dyes Inlet. Eelgrass depth range is positively correlated with the size of eelgrass beds. However, there is a lot of variability in both size of eelgrass beds, depth range, and maximum eelgrass depth among individual sites. This site-scale variability in depth limits is typical for eelgrass beds in greater Puget Sound (Hannam et al. 2015). The maximum depth of seagrass beds is often limited by the amount of light that is able to penetrate throughout the water column (Duarte 1991). As such, a reduction in the maximum depth of eelgrass beds is a possible indicator of water quality impairments (Burkholder et al. 2007). Many factors can influence water clarity in areas such as Puget Sound, including sediment resuspension due to wave action and tidal currents. Further research is needed to ascertain a potential link between water quality, light attenuation, and spatial patterns in the maximum depth extent of eelgrass beds in Puget Sound.

4.3 Zostera japonica in the East Kitsap Study Area

The non-native seagrass *Zostera japonica* has been detected at 58 out of 199 sites. This species tends to be more prevalent in Upper Kitsap (63% of sites), and the eastern side of Bainbridge Island (34% of sites) than in Lower Kitsap (23% of sites) and Port Orchard (21%

[5] For the purpose of designating ownership boundaries, the federal government defined the Extreme Low Tide line (ELT) as the line below which it might be reasonably expected that the tide would not ebb. In the Puget Sound area of Washington State this line is estimated by the federal government to be a point in elevation 4.5 ± 0.5 feet below the datum plane of MLLW (Ivey 2014).

of sites). *Zostera japonica* grows mostly at sites with *Zostera marina*. This would suggest that both species have relatively similar requirements in terms of substrate. Another possibility is that the presence of *Zostera marina* facilitates the growth of *Zostera japonica* in the intertidal.

Zostera japonica grows higher in the intertidal as compared to *Zostera marina*, and at most sites in the study area there is little overlap in the depth distribution of both species. This suggests that there is little competition between *Zostera marina* and *Zostera japonica*, and that *Zostera japonica* does not have negative effects on *Zostera marina* in areas where both species co-occur (Shafer et al. 2014, Harrison 1982, Hahn 2003). However, based on visual inspection, there are some sites where *Zostera japonica* appears abundant in the intertidal (cps1066, cps1069, and cps2215). At these locations, it was difficult to distinguish between both species in the video feed, so there is some uncertainty about our identification. Additional ground truthing is needed to confirm the spatial extent of *Zostera japonica* at these locations.

4.4 Trends in eelgrass area

Fifteen out of 199 sites were sampled with repeat transects. The time between the initial visit and the repeat sampling ranges from 1 to 8 years. Out of these 15 sites, 4 were classified as increasing, 2 sites were declining, and 9 were classified as stable. The sites with declines were sites where little eelgrass was present throughout the entire study period. At the time of sampling, cps1035 had mixed community of understory kelp, red/brown macroalgae, ulvoids, and green filamentous algae. Cps2105 was mostly covered by a dense mat of green algae. Sites with increases were located on the east side of the Kitsap Peninsula (cps2201, cps2218, cps2221) or the east side of Bainbridge Island (cps1069), and tend to have dense patchy/continuous eelgrass beds on sandy substrates. Increases happened throughout the entire depth range of eelgrass. There was no clear pattern over time in the deep and shallow edges of eelgrass beds at these sites.

4.5 Data use and availability

As a result of the interagency agreements between DNR, the City of Bainbridge Island and the Suquamish Tribe, the shoreline of the Kitsap Peninsula has become one of the most densely sampled areas for eelgrass status in greater Puget Sound. Surveying large contiguous stretches of shoreline, has generated detailed estimates of eelgrass area and depth distribution for the entire shoreline of the East Kitsap Study Area. These data provide a good overview of the current extent of both eelgrass (*Zostera marina*) and the non-native *Zostera japonica*, and can be used as baseline for future studies on trends in eelgrass area and depth distribution.

Eelgrass abundance, distribution and depth data identify sensitive habitat areas for consideration in land-use planning. Given the recognized ecological importance of eelgrass, planning should explicitly consider the location of eelgrass beds, its environmental requirements and potential habitat.

All data presented in this report will be available online in the next distribution dataset of DNR's Submerged Vegetation Monitoring Program (scheduled for late 2018). For more information, visit http://www.dnr.wa.gov/programs-and-services/aquatics/aquatic-science.

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6 Appendix 1: Summary Tables

Table 3: Eelgrass area at 190 sites sampled in 2014 and 2016, as part of the Bainbridge and Suquamish projects, supplemented with 9 sites sampled as part of SVMP in the same study area. Transect type indicates if sites were sampled with simple random transects (SRS), stratified random transects (STR) or reconnaissance transects (SUBJ).

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps1023	2016	Bainbridge	STR	0.168	5.08	0.85	0.36
cps1024	2016	Bainbridge	STR	0.115	4.39	0.5	0.29
cps1025	2016	Bainbridge	STR	0.076	3.75	0.28	0.15
cps1026	2016	Bainbridge	STR	0.031	5.71	0.18	0.18
cps1027	2016	Bainbridge	STR	0.457	11.36	5.19	0.76
cps1028	2016	Bainbridge	STR	0.297	6.8	2.02	0.5
cps1029	2016	Bainbridge	STR	0.319	5.36	1.71	0.49
cps1030	2016	Bainbridge	STR	0.249	5.48	1.37	0.54
cps1031	2016	Bainbridge	STR	0.124	5.47	0.68	0.29
cps1032	2016	Bainbridge	STR	0.334	7.32	2.44	0.64
cps1033	2016	Bainbridge	STR	0.468	4.34	2.03	0.48
cps1034	2016	Bainbridge	STR	0.056	7.59	0.43	0.25
cps1035	2016	SVMP	SRS	0.000	6.08	0.001	0
cps1036	2016	Bainbridge	STR	0.000	0	0	0
cps1037	2014	Suquamish	STR	0.000	0	0	0
cps1038	2016	Bainbridge	STR	0.000	0	0	0
cps1039	2014	Suquamish	STR	0.000	0	0	0
cps1040	2016	Bainbridge	STR	0.000	7.54	0	0
cps1041	2014	Suquamish	STR	0.000	0	0	0
cps1042	2016	Bainbridge	STR	0.000	0	0	0
cps1043	2014	Suquamish	STR	0.000	0	0	0
cps1044	2014	Suquamish	STR	0.000	0	0	0

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps1045	2014	Suquamish	STR	0.000	0	0	0
cps1046	2014	Suquamish	STR	0.018	4.88	0.09	0.08
cps1047	2014	Suquamish	STR	0.000	0	0	0
cps1048	2014	Suquamish	STR	0.000	0	0	0
cps1049	2014	Suquamish	STR	0.000	0	0	0
cps1050	2014	Suquamish	STR	0.000	0	0	0
cps1051	2014	Suquamish	STR	0.009	4.84	0.05	0.04
cps1052	2014	Suquamish	STR	0.490	8.41	4.12	0.26
cps1053	2014	Suquamish	STR	0.649	15.51	10.07	0.61
cps1054	2014	Suquamish	STR	0.214	4.55	0.98	0.34
cps1055	2016	Bainbridge	STR	0.259	6	1.55	0.53
cps1056	2016	Bainbridge	STR	0.457	8.05	3.68	0.51
cps1057	2014	Suquamish	STR	0.246	7.26	1.79	0.53
cps1058	2014	Suquamish	STR	0.156	10.15	1.58	0.4
cps1059	2014	Suquamish	STR	0.000	0	0	0
cps1060	2014	Suquamish	STR	0.063	11.05	0.7	0.27
cps1061	2014	Suquamish	STR	0.378	11.45	4.33	0.81
cps1062	2014	Suquamish	STR	0.676	10.77	7.28	0.26
cps1063	2014	Suquamish	STR	0.608	14.12	8.59	0.71
cps1064	2016	Suquamish	STR	0.413	29.19	12.06	1.41
cps1065	2016	Suquamish	STR	0.564	22.46	12.67	0.6
cps1066	2014	Suquamish	STR	0.340	30.59	10.4	1.37
cps1067	2016	Suquamish	STR	0.500	10.24	5.12	0.44
cps1068	2016	Suquamish	STR	0.152	8.89	1.36	0.77
cps1069	2014	Suquamish	STR	0.416	36.87	15.35	0.57
cps1070	2016	Suquamish	STR	0.453	15.01	6.79	0.33
cps1071	2016	Suquamish	STR	0.656	6.5	4.26	0.2
cps1072	2016	Suquamish	STR	0.405	8.98	3.63	0.96
cps1077	2016	Bainbridge	STR	0.011	4.69	0.05	0.03
cps1079	2016	Suquamish	STR	0.000	0	0	0
cps1080	2014	Suquamish	STR	0.170	5.91	1	0.7
cps1081	2014	Suquamish	STR	0.555	11.45	6.36	0.87
cps1082	2014	Suquamish	STR	0.648	15.62	10.12	1.29
cps1083	2016	Bainbridge	STR	0.000	0	0	0
cps1084	2016	Bainbridge	STR	0.000	0	0	0
cps1085	2016	Bainbridge	STR	0.000	0	0	0
cps1086	2014	Suquamish	SUBJ	0.000	0	0	0
cps1087	2014	Suquamish	SUBJ	0.000	0	0	0
cps1088	2014	Suquamish	SUBJ	0.000	0	0	0
cps1089	2014	Suquamish	SUBJ	0.000	0	0	0

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps1090	2014	Suquamish	SUBJ	0.000	0	0	0
cps1091	2014	Suquamish	SUBJ	0.000	0	0	0
cps1092	2014	Suquamish	SUBJ	0.000	0	0	0
cps1093	2014	Suquamish	SUBJ	0.000	0	0	0
cps1094	2014	Suquamish	SUBJ	0.000	0	0	0
cps1095	2014	Suquamish	SUBJ	0.000	0	0	0
cps1096	2014	Suquamish	SUBJ	0.000	0	0	0
cps1097	2014	Suquamish	SUBJ	0.000	0	0	0
cps1098	2014	Suquamish	SUBJ	0.000	0	0	0
cps1099	2014	Suquamish	SUBJ	0.000	0	0	0
cps1100	2014	Suquamish	SUBJ	0.000	0	0	0
cps1101	2014	Suquamish	SUBJ	0.000	0	0.0001	0
cps1102	2014	Suquamish	SUBJ	0.000	0	0	0
cps1103	2014	Suquamish	SUBJ	0.000	0	0	0
cps1104	2014	Suquamish	SUBJ	0.000	0	0	0
cps1105	2014	Suquamish	SUBJ	0.000	0	0	0
cps1106	2014	Suquamish	SUBJ	0.000	0	0	0
cps1107	2014	Suquamish	SUBJ	0.000	0	0	0
cps1108	2012	SVMP	SRS	0.631	5.71	3.6	0.2
cps1109	2016	Suquamish	STR	0.558	9.98	5.57	0.32
cps1110	2016	Suquamish	STR	0.419	28.14	11.8	1.84
cps1111	2016	Suquamish	STR	0.228	19.72	4.49	1.31
cps1112	2016	Suquamish	STR	0.777	8.62	6.7	0.31
cps1113	2016	Suquamish	STR	0.474	9.67	4.58	0.69
cps1114	2012	SVMP	SRS	0.342	0.52	0.18	0.03
cps1115	2016	Suquamish	STR	0.454	0.8	0.36	0.06
cps2101	2016	Suquamish	STR	0.466	10.18	4.74	0.92
cps2102	2012	SVMP	SRS	0.603	5.3	3.2	0.38
cps2103	2016	Suquamish	STR	0.034	16.14	0.56	0.55
cps2104	2016	Suquamish	STR	0.000	0	0	0
cps2105	2016	SVMP	SRS	0.004	16.76	0.07	0.04
cps2106	2016	Suquamish	STR	0.000	0	0	0
cps2107	2016	Suquamish	STR	0.000	0	0	0
cps2108	2016	Suquamish	STR	0.000	0	0	0
cps2109	2016	Suquamish	STR	0.049	8	0.39	0.18
cps2110	2016	Suquamish	STR	0.215	5.12	1.1	0.53
cps2111	2016	Suquamish	STR	0.086	3.85	0.33	0.32
cps2112	2016	Suquamish	STR	0.212	15.45	3.28	1.02
cps2113	2016	Suquamish	STR	0.357	7.96	2.84	1.37
cps2114	2016	Suquamish	STR	0.079	4.85	0.39	0.28

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps2115	2016	Suquamish	STR	0.000	0	0	0
cps2116	2016	Suquamish	STR	0.000	0	0	0
cps2117	2016	Suquamish	STR	0.000	0	0	0
cps2118	2014	Suquamish	STR	0.033	8.02	0.26	0.14
cps2119	2016	Suquamish	STR	0.040	8.43	0.34	0.33
cps2120	2014	Suquamish	STR	0.157	5.01	0.79	0.28
cps2121	2016	Suquamish	STR	0.000	0	0	0
cps2122	2016	Suquamish	STR	0.000	0	0	0
cps2123	2016	Suquamish	STR	0.000	0	0	0
cps2124	2016	Suquamish	STR	0.000	0	0	0
cps2125	2016	Suquamish	STR	0.000	0	0	0
cps2145	2012	SVMP	SUBJ	0.000	0	0	0
cps2148	2014	Suquamish	SUBJ	0.000	0	0	0
cps2149	2014	Suquamish	SUBJ	0.000	0	0	0
cps2150	2014	Suquamish	SUBJ	0.000	0	0	0
cps2154	2002	SVMP	SUBJ	0.000	0	0	0
cps2157	2002	SVMP	SUBJ	0.000	0	0	0
cps2158	2016	Suquamish	STR	0.000	0	0	0
cps2159	2016	Suquamish	STR	0.000	0	0	0
cps2160	2014	Suquamish	STR	0.100	4.12	0.41	0.21
cps2161	2016	Suquamish	STR	0.000	0	0	0
cps2162	2016	Suquamish	STR	0.000	0	0	0
cps2163	2016	Suquamish	STR	0.000	0	0	0
cps2164	2016	Suquamish	STR	0.000	0	0	0
cps2165	2016	Suquamish	STR	0.000	0	0	0
cps2166	2014	Suquamish	STR	0.000	0	0	0
cps2167	2014	Suquamish	STR	0.000	0	0	0
cps2168	2014	Suquamish	STR	0.051	9.49	0.49	0.35
cps2169	2014	Suquamish	STR	0.270	7.11	1.92	0.27
cps2170	2014	Suquamish	STR	0.103	11.36	1.16	0.29
cps2171	2014	Suquamish	STR	0.059	13.42	0.79	0.29
cps2172	2014	Suquamish	STR	0.000	0	0	0
cps2173	2014	Suquamish	STR	0.000	0	0	0
cps2174	2016	Suquamish	STR	0.000	0	0	0
cps2175	2016	Suquamish	STR	0.000	0	0	0
cps2176	2016	Suquamish	STR	0.000	0	0	0
cps2179	2016	Suquamish	STR	0.000	0	0	0
cps2180	2016	Suquamish	STR	0.000	0	0	0
cps2181	2016	Suquamish	STR	0.000	0	0	0
cps2182	2012	SVMP	SUBJ	0.000	0	0	0

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps2183	2014	Suquamish	STR	0.016	6.37	0.1	0.1
cps2184	2014	Suquamish	STR	0.156	9.31	1.45	0.47
cps2185	2014	Suquamish	STR	0.010	7.74	0.08	0.07
cps2186	2014	Suquamish	STR	0.107	13.19	1.4	0.58
cps2187	2014	Suquamish	STR	0.437	24.93	10.9	1.56
cps2188	2014	Suquamish	STR	0.352	18.19	6.41	1.39
cps2189	2016	Suquamish	STR	0.103	4.09	0.42	0.26
cps2190	2016	Suquamish	STR	0.132	5.53	0.73	0.51
cps2191	2016	Suquamish	STR	0.604	6.74	4.07	0.34
cps2192	2014	Suquamish	STR	0.252	9.53	2.4	0.79
cps2193	2014	Suquamish	STR	0.523	30.71	16.06	1.34
cps2194	2014	Suquamish	STR	0.348	28.99	10.08	1.15
cps2195	2014	Suquamish	STR	0.339	34.03	11.55	0.82
cps2196	2014	Suquamish	STR	0.390	14.85	5.79	0.87
cps2197	2014	Suquamish	STR	0.377	16.14	6.09	0.94
cps2198	2016	Suquamish	STR	0.045	3.76	0.17	0.07
cps2199	2016	Suquamish	STR	0.181	8.82	1.6	0.53
cps2200	2016	Suquamish	STR	0.674	19.29	13	0.84
cps2201	2014	Suquamish	STR	0.588	16.24	9.54	1.17
cps2202	2016	Suquamish	STR	0.711	11.62	8.25	0.45
cps2203	2014	Suquamish	STR	0.456	13.47	6.15	1.2
cps2204	2014	Suquamish	STR	0.509	10.87	5.53	0.46
cps2205	2016	Suquamish	STR	0.698	16.88	11.78	0.85
cps2206	2014	Suquamish	STR	0.320	38.42	12.29	2.82
cps2207	2016	Suquamish	STR	0.555	15.06	8.35	0.82
cps2208	2014	Suquamish	STR	0.426	26.28	11.19	1
cps2209	2016	Suquamish	STR	0.396	14.92	5.9	0.46
cps2210	2016	Suquamish	STR	0.652	9.55	6.22	0.38
cps2211	2014	Suquamish	STR	0.612	9.89	6.05	0.35
cps2212	2014	Suquamish	STR	0.628	12.49	7.84	0.25
cps2213	2014	Suquamish	STR	0.584	19.88	11.62	0.54
cps2214	2016	Suquamish	STR	0.542	22.52	12.21	0.74
cps2215	2014	Suquamish	STR	0.370	20.48	7.58	0.57
cps2216	2016	Suquamish	STR	0.579	18.54	10.72	0.76
cps2217	2016	Suquamish	STR	0.525	23.46	12.33	0.86
cps2218	2014	Suquamish	STR	0.203	23.18	4.7	0.65
cps2219	2016	Suquamish	STR	0.463	35.62	16.48	0.97
cps2220	2014	Suquamish	STR	0.523	43.65	22.83	0.78
cps2221	2014	Suquamish	STR	0.343	27.97	9.59	0.54
cps2222	2014	Suquamish	STR	0.419	8.52	3.57	0.57

site_code	year	project	transect type	vegetated fraction	sample area (ha)	eelgrass area (ha)	standard error (ha)
cps2223	2014	Suquamish	STR	0.638	10.8	6.89	0.53
cps2224	2016	Suquamish	STR	0.373	5.6	2.09	0.47
cps2225	2014	Suquamish	STR	0.406	10.78	4.38	0.7
cps2226	2016	Suquamish	STR	0.670	15.46	10.35	0.86
cps2227	2014	Suquamish	STR	0.795	22.82	18.13	0.74
cps2228	2016	Suquamish	STR	0.800	23.03	18.42	0.96
cps2229	2016	Suquamish	STR	0.288	8.4	2.42	0.79
cps2230	2014	Suquamish	STR	0.089	9.31	0.83	0.48
cps2889	2016	Bainbridge	STR	0.000	0	0	0
cps2890	2014	Suquamish	STR	0.174	9.13	1.59	0.41
cps2891	2016	Suquamish	STR	0.180	5.05	0.91	0.35
cps2892	2016	Suquamish	STR	0.000	0	0	0
flats36	2016	Bainbridge	STR	0.000	0	0	0
flats37	2014	Suquamish	STR	0.285	47.39	13.48	4.07
flats38	2016	Suquamish	STR	0.000	37.63	0	0
flats39	2016	Suquamish	SUBJ	0.000	0	0	0
flats40	2014	Suquamish	STR	0.047	69.78	3.29	1.58

Table 4: Summary of the depth distribution of eelgrass observations at individual sites; q05 is the 5th percentile of depth observations, q10 the 10th percentile, etc. The median depth at each site is q50. The last column shows the number of depth observations used to calculate the depth distribution of eelgrass at each site.

site_code	year	project	maxd	q05	q10	q25	q50	q75	q90	q95	mind	n
cps1023	2016	Bainbridge	-3.30	-2.19	-1.94	-1.42	-0.87	-0.50	-0.30	-0.27	-0.19	110
cps1024	2016	Bainbridge	-2.51	-2.28	-2.14	-1.32	-0.70	-0.47	-0.32	-0.29	-0.21	69
cps1025	2016	Bainbridge	-3.42	-2.76	-2.49	-1.75	-1.12	-0.88	-0.82	-0.74	-0.50	52
cps1026	2016	Bainbridge	-3.74	-3.47	-3.29	-2.86	-2.55	-1.97	-1.82	-1.72	-1.68	44
cps1027	2016	Bainbridge	-4.99	-4.03	-3.71	-2.64	-1.51	-0.57	-0.04	0.05	0.33	621
cps1028	2016	Bainbridge	-4.37	-3.71	-3.42	-2.95	-2.17	-1.51	-0.76	-0.54	-0.18	250
cps1029	2016	Bainbridge	-4.70	-3.85	-3.38	-2.80	-2.09	-1.40	-0.73	-0.54	-0.21	201
cps1030	2016	Bainbridge	-3.84	-2.72	-2.30	-1.48	-0.83	-0.14	0.13	0.29	0.53	191
cps1031	2016	Bainbridge	-2.40	-2.14	-1.94	-1.52	-0.52	-0.14	0.06	0.11	0.17	95
cps1032	2016	Bainbridge	-5.34	-5.01	-4.84	-2.58	-1.55	-0.84	-0.23	0.18	0.54	294
cps1033	2016	Bainbridge	-4.22	-3.43	-2.73	-1.81	-1.13	-0.56	-0.23	-0.14	0.14	308
cps1034	2016	Bainbridge	-3.00	-2.30	-2.03	-1.64	-1.29	-1.14	-1.00	-0.92	-0.81	53
cps1046	2014	Suquamish	-1.31	-1.26	-1.22	-1.11	-1.01	-0.82	-0.77	-0.74	-0.72	10
cps1051	2014	Suquamish	-2.85	-2.61	-2.37	-1.65	-1.63	-1.58	-1.56	-1.56	-1.56	5
cps1052	2014	Suquamish	-3.94	-3.13	-2.82	-2.34	-1.21	-0.56	-0.16	-0.02	0.43	498
cps1053	2014	Suquamish	-4.73	-3.67	-3.26	-2.32	-1.21	-0.34	-0.03	0.11	0.83	1059
cps1054	2014	Suquamish	-2.75	-2.41	-1.95	-1.16	-0.73	-0.46	0.00	0.19	0.58	116
cps1055	2016	Bainbridge	-4.54	-3.46	-2.73	-1.46	-0.66	-0.13	0.19	0.41	0.68	210
cps1056	2016	Bainbridge	-4.58	-4.11	-3.68	-2.83	-1.82	-1.06	-0.03	0.19	0.55	518
cps1057	2014	Suquamish	-3.43	-1.82	-1.68	-1.35	-0.86	-0.24	0.27	0.54	0.68	219
cps1058	2014	Suquamish	-3.45	-2.54	-2.12	-1.67	-1.23	-0.76	0.36	0.51	0.85	223
cps1060	2014	Suquamish	-4.49	-4.15	-3.85	-3.05	-2.68	-2.17	-1.59	-1.28	-0.74	80
cps1061	2014	Suquamish	-6.70	-3.24	-2.68	-1.66	-1.15	-0.83	-0.26	0.05	0.41	575
cps1062	2014	Suquamish	-4.45	-3.48	-2.90	-1.70	-0.51	0.11	0.39	0.56	0.93	912
cps1063	2014	Suquamish	-5.09	-3.57	-2.70	-1.62	-0.61	-0.03	0.41	0.66	1.18	975
cps1064	2016	Suquamish	-7.34	-3.24	-2.44	-1.29	-0.33	0.00	0.18	0.29	0.81	1356
cps1065	2016	Suquamish	-4.74	-3.15	-2.92	-2.35	-1.28	-0.40	-0.01	0.18	0.72	1609
cps1066	2014	Suquamish	-6.13	-4.00	-3.60	-2.74	-1.36	-0.06	0.29	0.36	1.11	1158
cps1067	2016	Suquamish	-5.55	-3.27	-2.58	-1.67	-0.78	-0.19	0.10	0.29	1.12	651
cps1068	2016	Suquamish	-6.36	-4.75	-4.53	-3.74	-3.16	-2.03	-1.60	-1.36	-0.28	181
cps1069	2014	Suquamish	-5.10	-3.99	-3.70	-2.98	-1.91	-0.66	-0.18	0.02	0.75	1392
cps1070	2016	Suquamish	-4.81	-3.09	-2.60	-1.76	-0.88	-0.12	0.25	0.49	1.02	791
cps1071	2016	Suquamish	-5.51	-4.28	-3.65	-2.27	-1.33	-0.54	-0.10	0.00	0.21	558
cps1072	2016	Suquamish	-12.33	-6.01	-5.10	-3.66	-2.22	-1.41	-1.01	-0.84	0.03	407
cps1077	2016	Bainbridge	-1.60	-1.58	-1.55	-1.49	-1.44	-0.60	-0.29	-0.26	-0.24	6
cps1080	2014	Suquamish	-5.03	-2.16	-1.81	-1.63	-1.54	-1.35	-0.43	0.02	0.46	171

site_code	year	project	maxd	q05	q10	q25	q50	q75	q90	q95	mind	n
cps1081	2014	Suquamish	-5.51	-3.16	-2.46	-1.66	-1.14	-0.68	-0.48	-0.32	0.15	1338
cps1082	2014	Suquamish	-5.45	-3.98	-3.50	-2.61	-1.72	-1.16	-0.62	-0.42	0.16	927
cps1108	2012	SVMP	-7.55	-6.03	-5.49	-4.36	-2.24	-1.05	-0.61	-0.44	-0.02	798
cps1109	2016	Suquamish	-6.35	-4.85	-4.19	-2.89	-1.26	-0.51	-0.14	0.18	1.05	788
cps1110	2016	Suquamish	-6.19	-4.23	-3.92	-3.07	-1.89	-1.08	-0.35	-0.06	0.67	1747
cps1111	2016	Suquamish	-5.46	-4.44	-4.12	-3.54	-2.91	-1.01	-0.27	0.21	0.86	556
cps1112	2016	Suquamish	-5.38	-4.17	-3.70	-2.95	-2.07	-1.08	-0.43	-0.19	0.36	907
cps1113	2016	Suquamish	-6.75	-4.07	-3.79	-3.27	-2.54	-0.91	-0.26	0.01	1.20	594
cps1114	2012	SVMP	-5.84	-4.52	-4.21	-3.01	-1.93	-1.20	-0.90	-0.80	-0.49	244
cps1115	2016	Suquamish	-6.99	-6.00	-5.27	-3.76	-1.50	-0.73	-0.53	-0.40	-0.04	182
cps2101	2016	Suquamish	-4.73	-3.65	-3.17	-2.54	-1.46	-0.70	-0.35	-0.09	0.28	586
cps2102	2012	SVMP	-5.09	-3.68	-3.31	-2.71	-2.08	-1.63	-1.23	-1.03	-0.29	1382
cps2103	2016	Suquamish	-3.12	-2.86	-2.68	-2.35	-1.92	-1.64	-1.02	-0.95	-0.83	54
cps2105	2016	SVMP	-1.96	-1.94	-1.92	-1.88	-1.58	-1.54	-1.51	-1.51`	-1.51	12
cps2109	2016	Suquamish	-3.22	-2.97	-2.52	-1.25	-1.03	-0.90	-0.82	-0.62	-0.31	46
cps2110	2016	Suquamish	-4.35	-3.84	-3.66	-2.59	-2.22	-1.88	-1.50	-1.39	-1.10	181
cps2111	2016	Suquamish	-2.14	-1.97	-1.84	-1.42	-0.97	-0.67	-0.38	-0.26	-0.25	49
cps2112	2016	Suquamish	-4.51	-3.09	-2.50	-1.79	-1.27	-1.00	-0.62	-0.30	0.22	410
cps2113	2016	Suquamish	-4.74	-3.78	-2.96	-2.27	-1.43	-0.50	0.14	0.39	0.59	352
cps2114	2016	Suquamish	-2.16	-1.55	-1.46	-0.92	-0.45	-0.20	0.09	0.11	0.27	62
cps2118	2014	Suquamish	-2.39	-2.32	-2.22	-2.03	-1.67	-1.52	-1.38	-1.31	-1.27	29
cps2119	2016	Suquamish	-2.28	-2.26	-2.14	-2.03	-1.79	-1.32	-1.06	-1.01	-0.86	38
cps2120	2014	Suquamish	-3.01	-2.22	-2.02	-1.80	-1.48	-1.21	-1.08	-0.99	-0.87	106
cps2160	2014	Suquamish	-2.93	-2.28	-2.04	-1.58	-1.27	-0.82	-0.58	-0.47	-0.36	59
cps2168	2014	Suquamish	-2.13	-1.80	-1.55	-1.28	-0.90	-0.54	-0.27	-0.24	-0.15	72
cps2169	2014	Suquamish	-2.20	-1.89	-1.71	-1.45	-1.02	-0.70	-0.47	-0.37	-0.16	241
cps2170	2014	Suquamish	-1.64	-1.48	-1.40	-1.25	-0.93	-0.72	-0.59	-0.51	-0.41	162
cps2171	2014	Suquamish	-1.53	-1.38	-1.25	-1.01	-0.78	-0.54	-0.38	-0.24	0.75	107
cps2183	2014	Suquamish	-0.34	-0.22	-0.18	-0.16	-0.13	-0.12	-0.09	-0.09	-0.08	16
cps2184	2014	Suquamish	-1.13	-1.03	-0.97	-0.88	-0.78	-0.63	-0.44	-0.38	-0.22	211
cps2185	2014	Suquamish	-1.19	-1.19	-1.19	-1.17	-1.12	-1.04	-0.99	-0.96	-0.93	10
cps2186	2014	Suquamish	-4.29	-3.88	-3.81	-3.73	-2.55	-1.59	-0.54	-0.19	-0.01	182
cps2187	2014	Suquamish	-5.84	-3.61	-3.27	-2.43	-1.65	-0.67	-0.11	0.00	0.32	1286
cps2188	2014	Suquamish	-6.22	-3.34	-2.83	-2.43	-1.84	-1.10	-0.56	-0.45	0.28	711
cps2189	2016	Suquamish	-4.04	-3.58	-2.90	-1.16	-0.94	-0.57	-0.39	0.36	0.64	57
cps2190	2016	Suquamish	-2.69	-2.39	-2.22	-1.61	-0.95	-0.35	-0.01	0.10	0.19	102
cps2191	2016	Suquamish	-3.46	-2.42	-2.14	-1.50	-0.72	-0.15	0.22	0.39	0.65	612
cps2192	2014	Suquamish	-4.09	-3.59	-3.36	-2.86	-2.12	-1.40	-0.72	-0.43	0.06	311
cps2193	2014	Suquamish	-3.89	-3.11	-3.00	-2.53	-0.90	-0.38	-0.16	-0.06	0.24	1485
cps2194	2014	Suquamish	-3.74	-3.04	-2.50	-1.51	-0.55	0.02	0.29	0.34	0.92	1132

site_code	year	project	maxd	q05	q10	q25	q50	q75	q90	q95	mind	n
cps2195	2014	Suquamish	-6.40	-3.47	-3.17	-2.02	-0.71	-0.25	0.20	0.57	1.02	1259
cps2196	2014	Suquamish	-3.88	-3.25	-2.98	-2.24	-1.04	-0.24	0.12	0.28	0.80	840
cps2197	2014	Suquamish	-4.53	-4.14	-3.86	-3.22	-1.98	-0.79	-0.25	-0.02	0.61	672
cps2198	2016	Suquamish	-2.74	-2.57	-2.49	-2.37	-1.95	-1.10	-0.48	-0.44	-0.39	28
cps2199	2016	Suquamish	-4.54	-3.40	-3.28	-2.87	-2.44	-1.84	-1.00	-0.88	-0.60	222
cps2200	2016	Suquamish	-6.28	-3.65	-3.14	-1.75	-0.89	-0.53	0.05	0.51	1.31	1578
cps2201	2014	Suquamish	-7.43	-4.92	-4.49	-3.63	-2.20	-1.18	-0.29	-0.03	0.59	1270
cps2202	2016	Suquamish	-5.46	-4.12	-3.59	-2.40	-1.42	-0.49	-0.05	0.27	0.94	1079
cps2203	2014	Suquamish	-6.28	-4.67	-3.83	-2.66	-1.25	-0.15	0.19	0.44	1.07	691
cps2204	2014	Suquamish	-5.85	-4.58	-3.83	-2.32	-1.26	-0.34	0.24	0.46	0.95	680
cps2205	2016	Suquamish	-5.02	-3.51	-3.09	-2.19	-1.08	-0.12	0.44	0.61	0.93	1219
cps2206	2014	Suquamish	-4.31	-2.00	-1.60	-0.97	-0.58	-0.19	0.08	0.25	0.86	1813
cps2207	2016	Suquamish	-5.15	-4.33	-4.04	-3.21	-2.29	-1.13	-0.20	0.15	0.63	1266
cps2208	2014	Suquamish	-6.00	-5.11	-4.79	-4.19	-1.91	-0.28	-0.07	0.07	0.91	1352
cps2209	2016	Suquamish	-5.40	-2.42	-1.55	-0.50	-0.16	0.14	0.50	0.62	1.03	902
cps2210	2016	Suquamish	-8.77	-4.19	-3.39	-2.08	-1.06	-0.18	0.07	0.29	0.57	880
cps2211	2014	Suquamish	-5.24	-3.90	-3.17	-2.31	-1.52	-0.79	-0.45	-0.31	-0.03	649
cps2212	2014	Suquamish	-3.89	-3.29	-2.96	-2.06	-1.13	-0.24	0.14	0.31	0.66	915
cps2213	2014	Suquamish	-5.28	-4.46	-4.14	-3.31	-2.17	-0.70	-0.14	0.16	0.62	1343
cps2214	2016	Suquamish	-7.62	-4.06	-3.04	-1.26	-0.19	0.16	0.35	0.46	0.97	1605
cps2215	2014	Suquamish	-6.60	-4.41	-3.34	-1.64	-0.64	-0.12	0.18	0.39	0.93	919
cps2216	2016	Suquamish	-5.72	-4.42	-4.11	-3.34	-2.19	-0.81	-0.05	0.21	0.60	1332
cps2217	2016	Suquamish	-5.77	-4.68	-4.33	-3.73	-2.05	-0.35	-0.04	0.10	0.60	1498
cps2218	2014	Suquamish	-6.05	-2.36	-1.61	-1.10	-0.66	0.21	0.58	0.63	1.21	557
cps2219	2016	Suquamish	-6.01	-1.65	-0.85	-0.32	0.05	0.42	0.60	0.65	0.99	2130
cps2220	2014	Suquamish	-5.68	-4.14	-3.29	-2.24	-0.81	-0.12	0.32	0.48	0.94	2618
cps2221	2014	Suquamish	-6.65	-4.03	-3.12	-1.74	-0.74	-0.38	-0.02	0.22	0.94	1043
cps2222	2014	Suquamish	-6.33	-4.98	-3.95	-2.43	-1.25	-0.08	0.16	0.25	0.53	416
cps2223	2014	Suquamish	-6.97	-5.05	-3.84	-1.74	-0.70	0.28	0.56	0.68	1.00	764
cps2224	2016	Suquamish	-6.10	-4.89	-4.25	-2.37	-1.53	-1.04	-0.66	-0.49	-0.19	256
cps2225	2014	Suquamish	-5.83	-4.64	-4.26	-3.38	-2.39	-1.54	-1.01	-0.73	-0.27	611
cps2226	2016	Suquamish	-6.48	-5.27	-4.82	-4.09	-3.31	-1.97	-0.90	-0.63	-0.23	1242
cps2227	2014	Suquamish	-6.04	-5.29	-4.93	-4.12	-3.29	-2.42	-1.29	-0.81	0.07	1687
cps2228	2016	Suquamish	-6.74	-5.41	-4.75	-3.64	-2.70	-1.99	-0.97	-0.47	0.63	2109
cps2229	2016	Suquamish	-5.41	-3.52	-3.28	-2.77	-2.30	-1.60	-0.37	-0.24	-0.08	418
cps2230	2014	Suquamish	-3.97	-3.63	-3.51	-3.02	-2.22	-1.43	-0.81	-0.55	-0.37	121
cps2890	2014	Suquamish	-7.12	-3.49	-2.90	-1.93	-1.29	-0.81	0.13	0.29	0.49	326
cps2891	2016	Suquamish	-3.06	-2.90	-2.71	-2.29	-1.75	-1.43	-1.01	-0.78	-0.30	196
flats37	2014	Suquamish	-6.90	-4.27	-3.67	-3.01	-2.21	-1.53	-1.10	-0.96	-0.50	994
flats40	2014	Suquamish	-2.32	-1.62	-1.50	-1.17	-0.46	-0.02	0.06	0.31	0.49	316

7 Appendix 2: Overview Maps

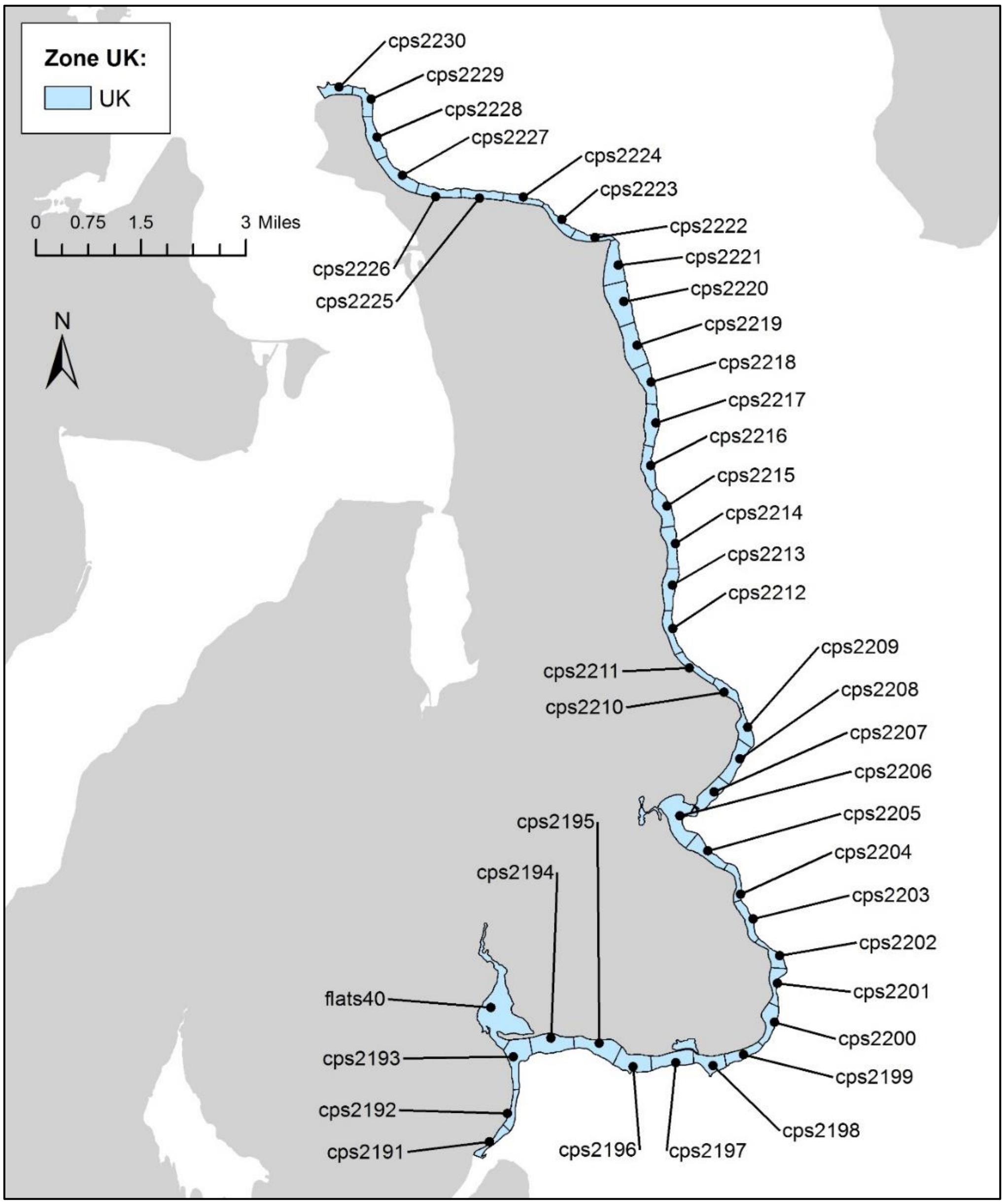


Figure 24: overview map for the upper Kitsap Peninsula (UK)

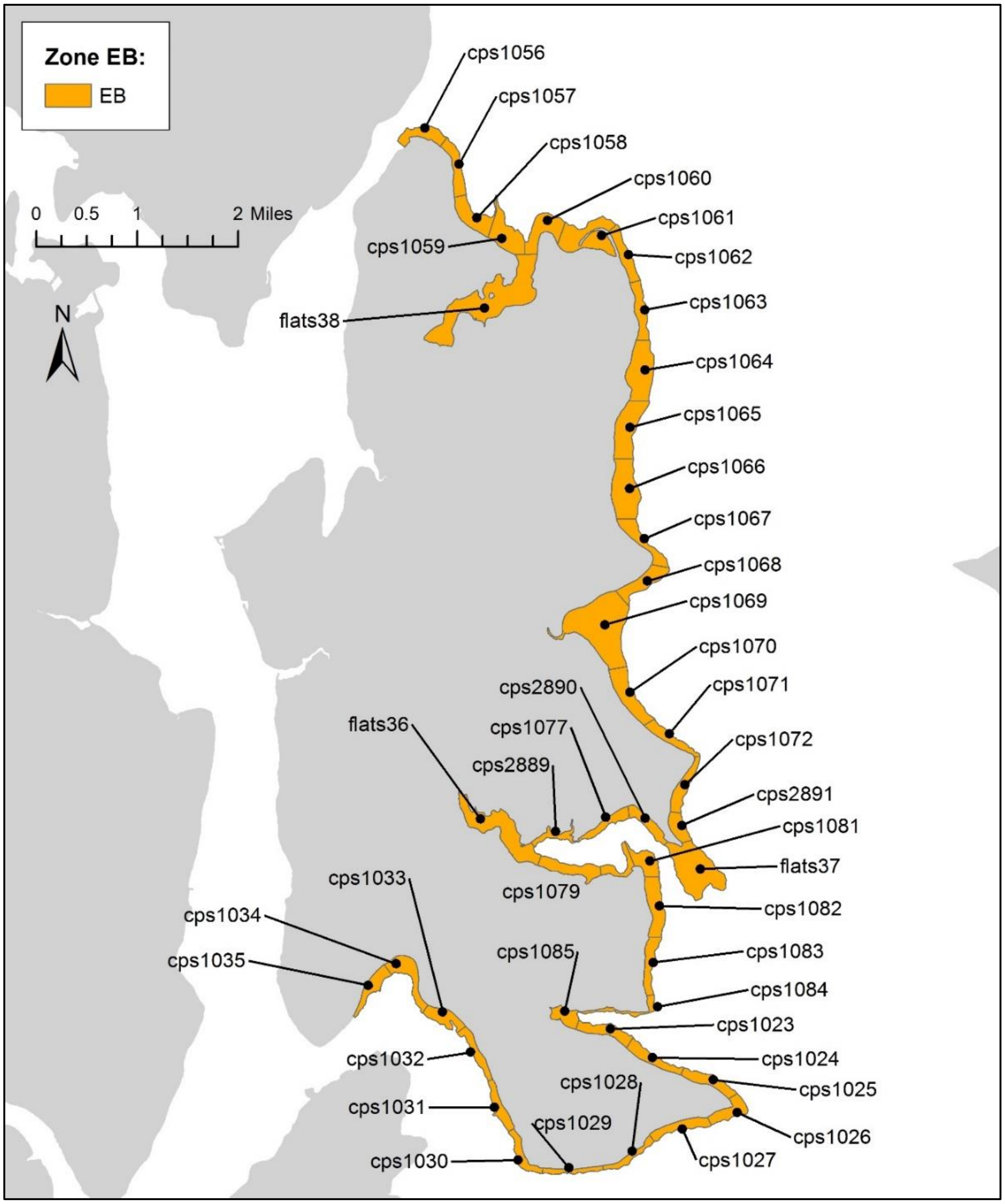


Figure 25: overview map for East Bainbridge (EB)

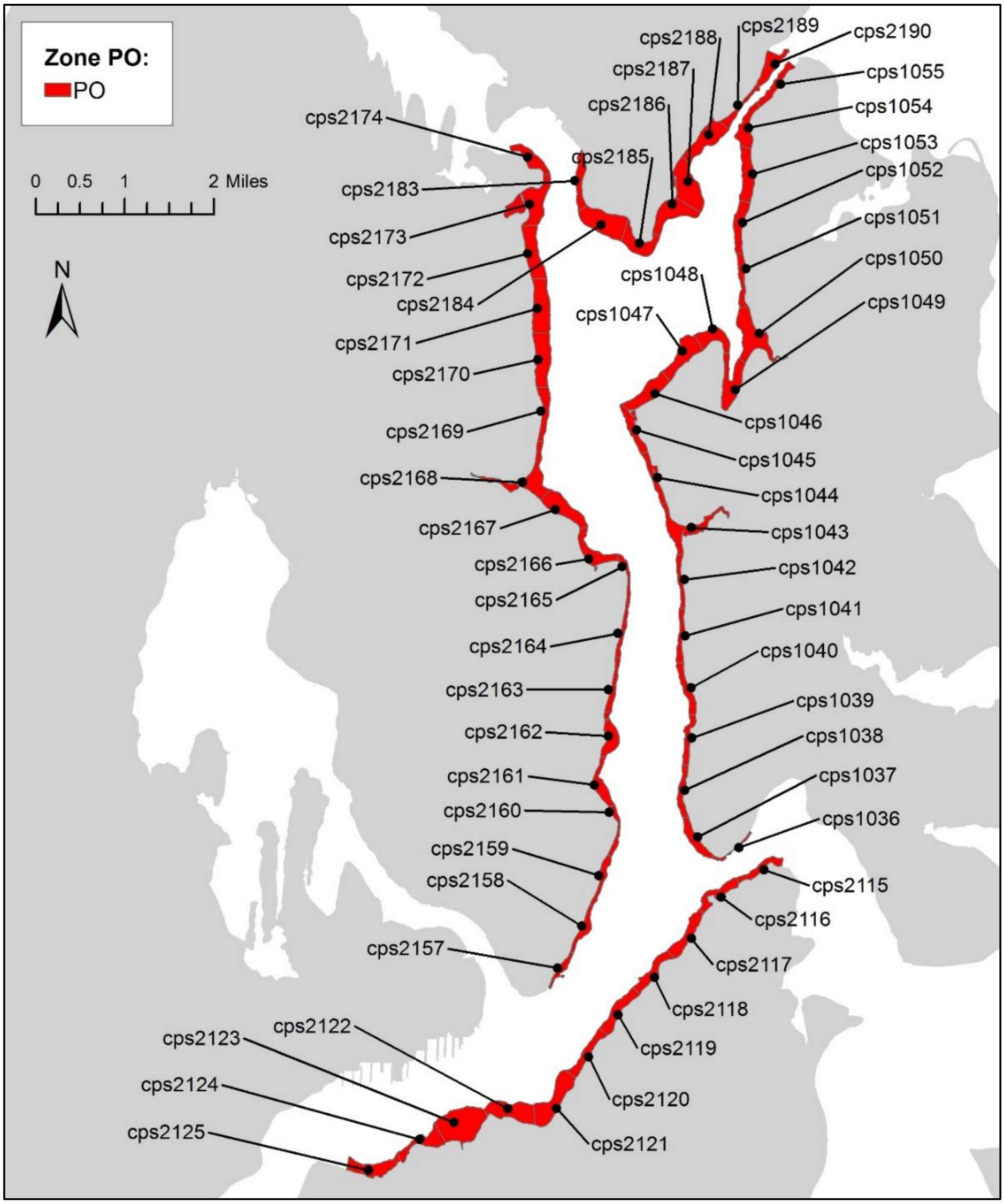


Figure 26: overview map for Port Orchard (PO)

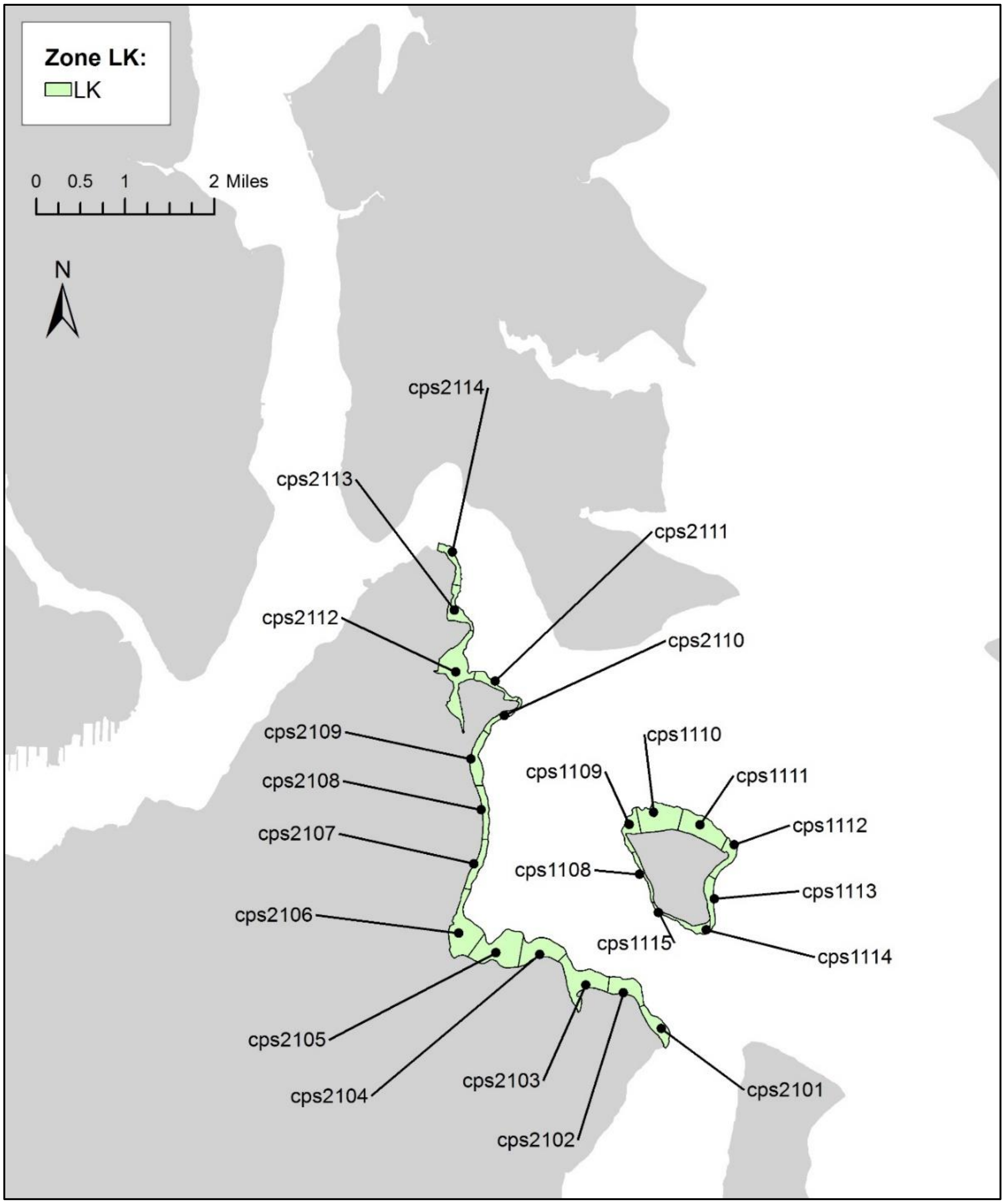


Figure 27: overview map for lower Kitsap (LK)

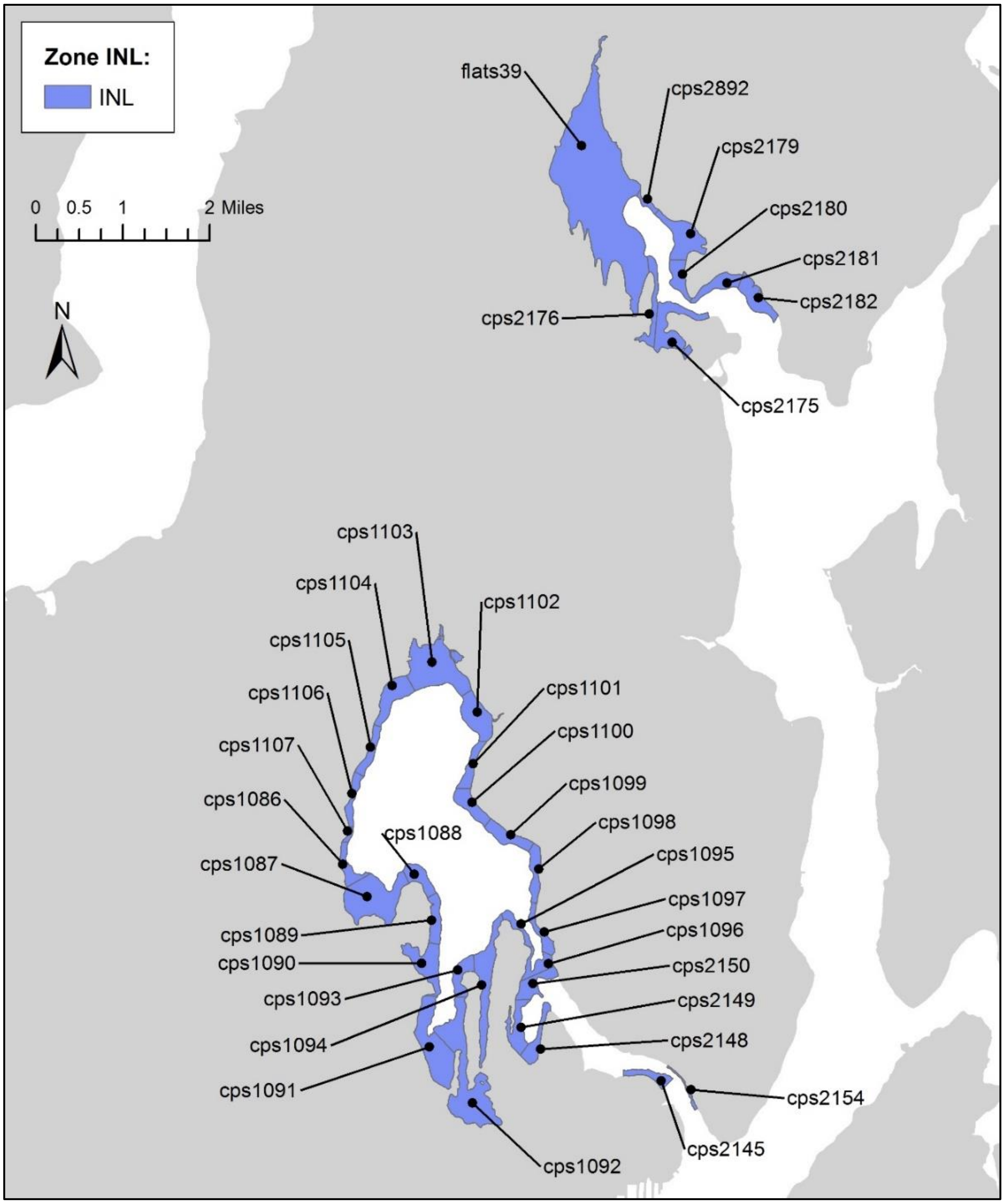
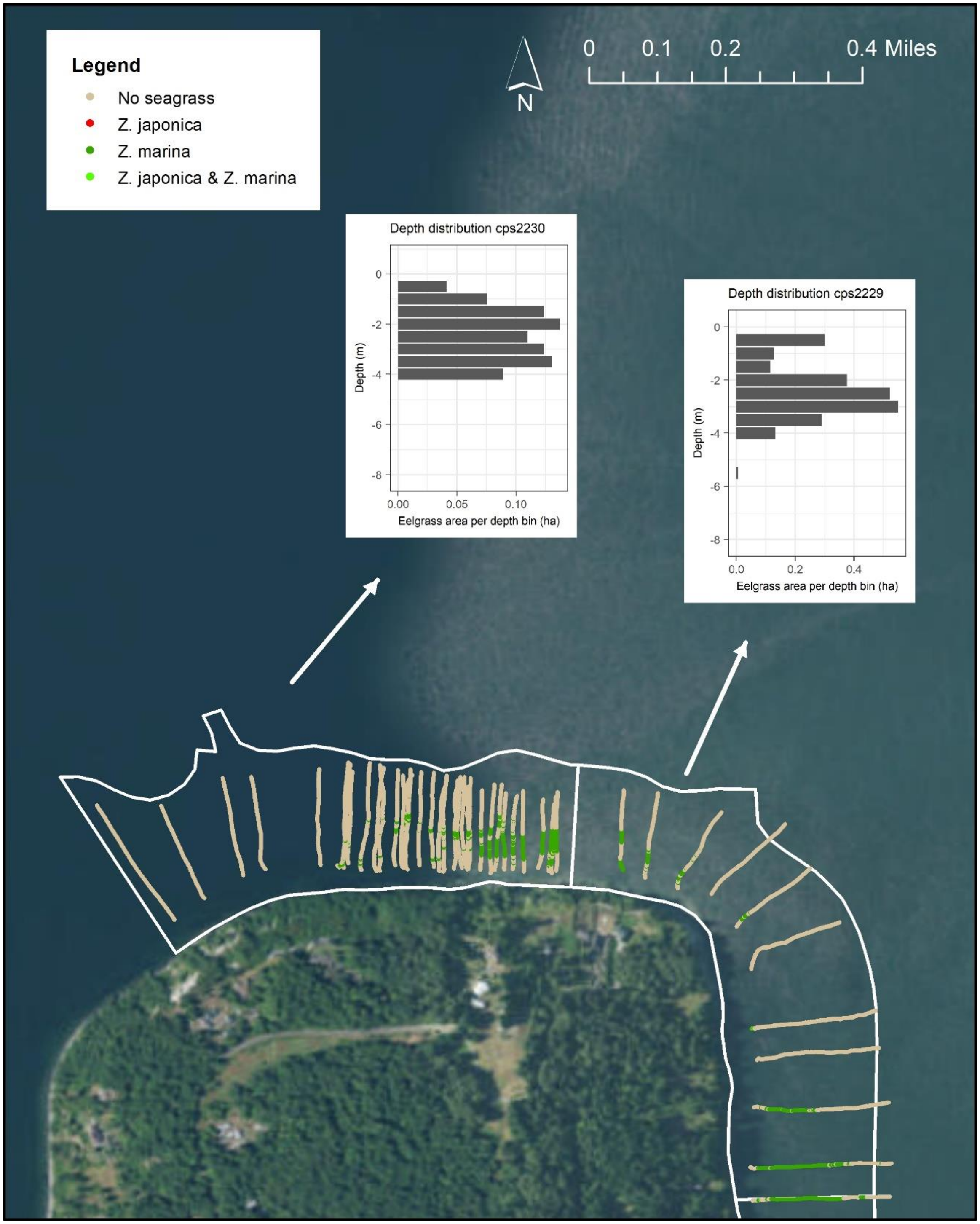


Figure 28: overview map for Dyes Inlet and Liberty Bay (INL)

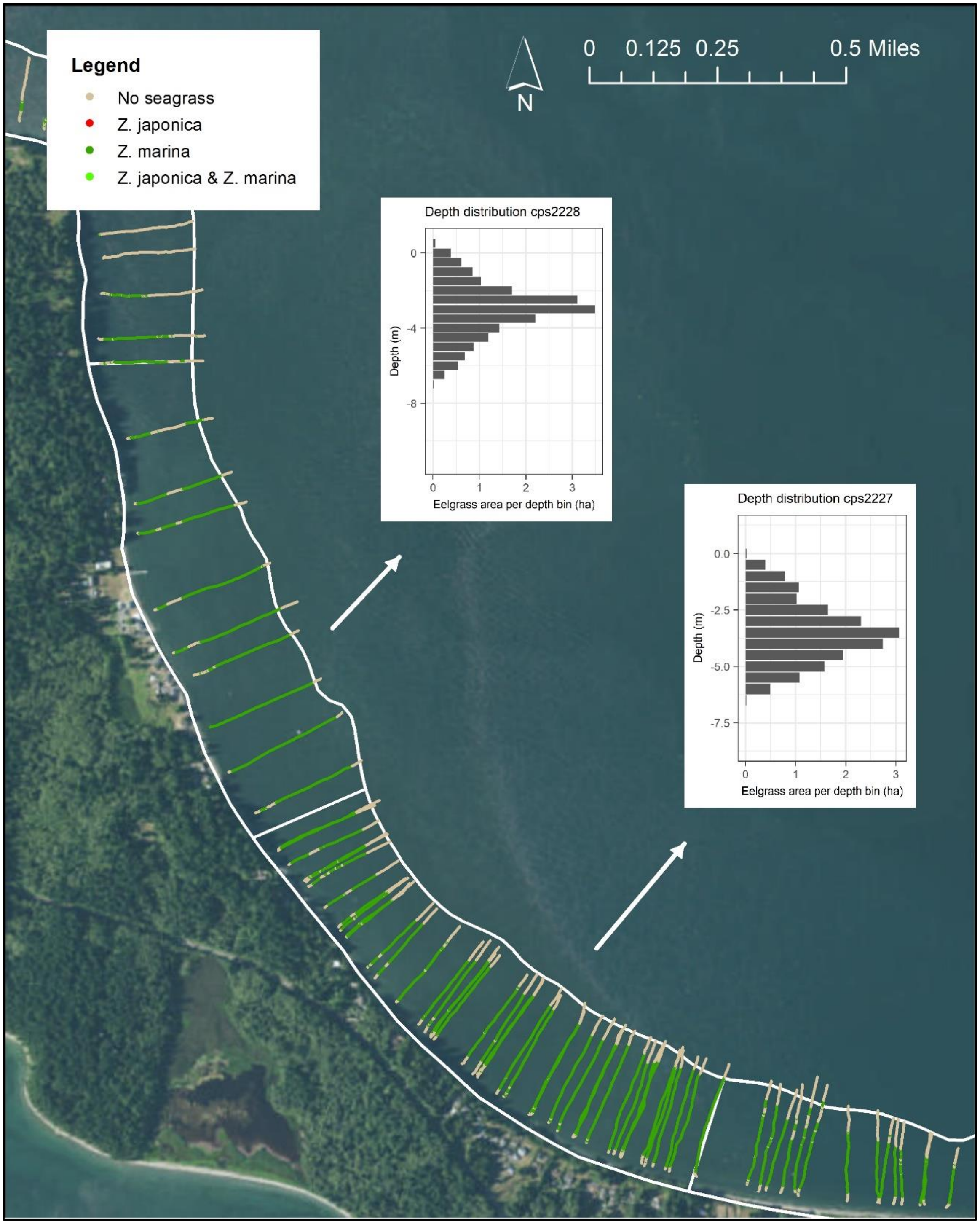
8 Appendix 3: Site Maps

This appendix contains site maps for all sites sampled as part of IAA 15-17 amendment1 and IAA 16-239. Sites where *Zostera marina* was detected include a graph with the depth distribution (represented by a histogram of observations vs. depth). At 4 sites (cps1090, cps2148, cps2149 & cps2150), GPS coordinates were not collected due to equipment malfunction. As such, these sites are not represented in the maps. At none of these 4 sites was eelgrass present.

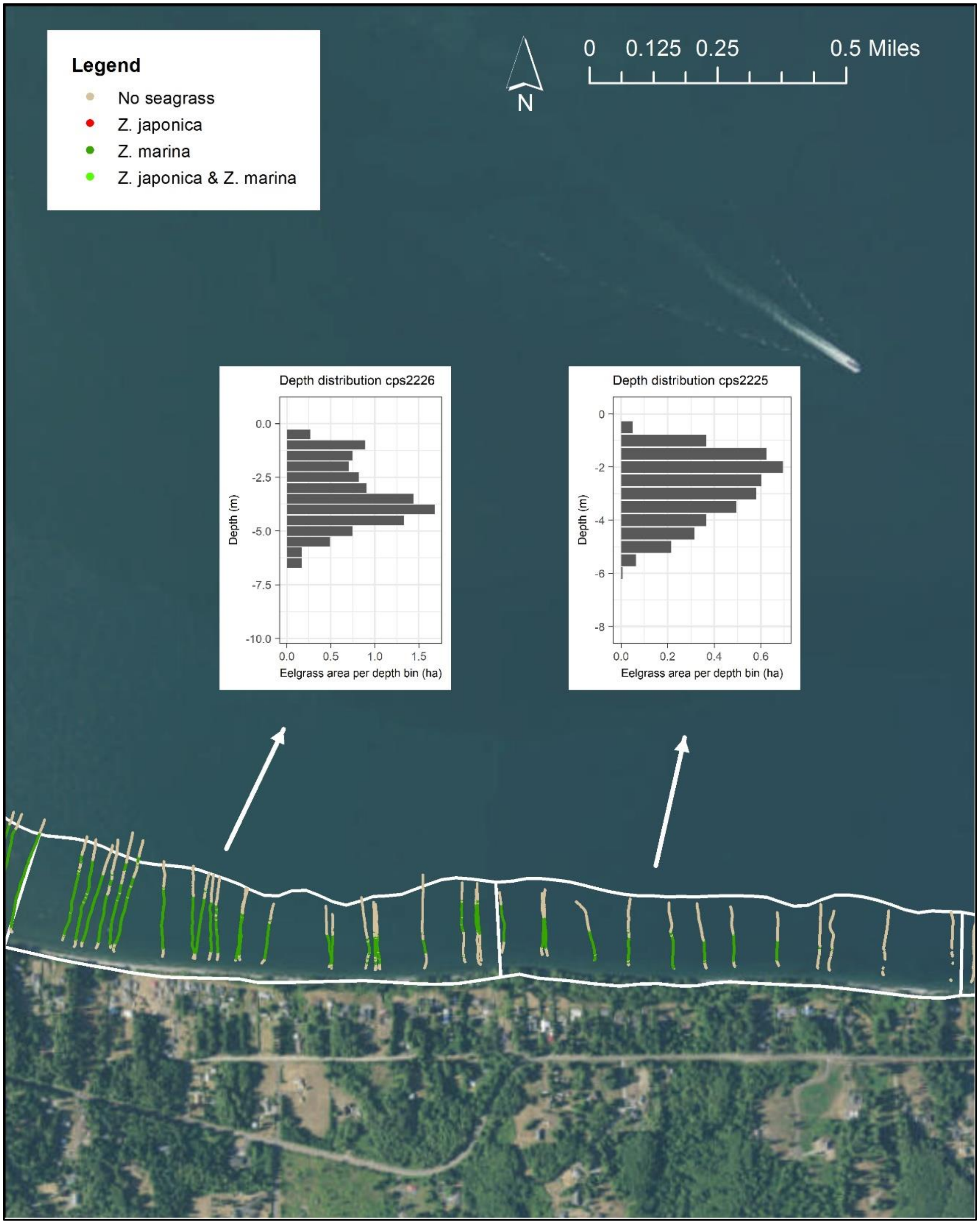
Site maps ordered from North to South along the shore of the Kitsap Peninsula, followed by the sites around Bainbridge Island.

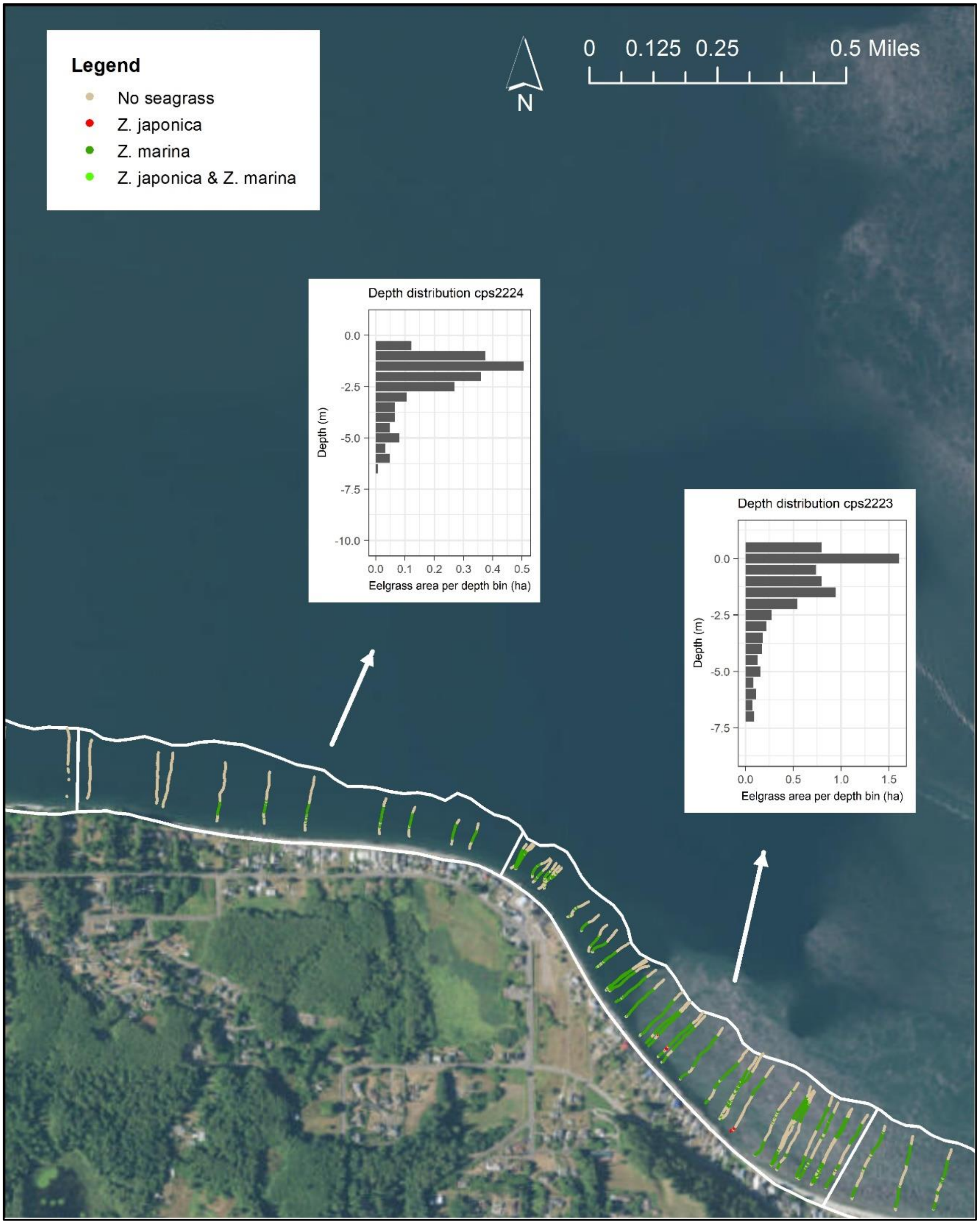


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.1
0.2
0.4 Miles
Depth distribution cps2230
Depth (m)
Eelgrass area per depth bin (ha)
0.00
0.05
0.10
Depth distribution cps2229
0.0
0.2
0.4
0
-2
-4
-6
-8

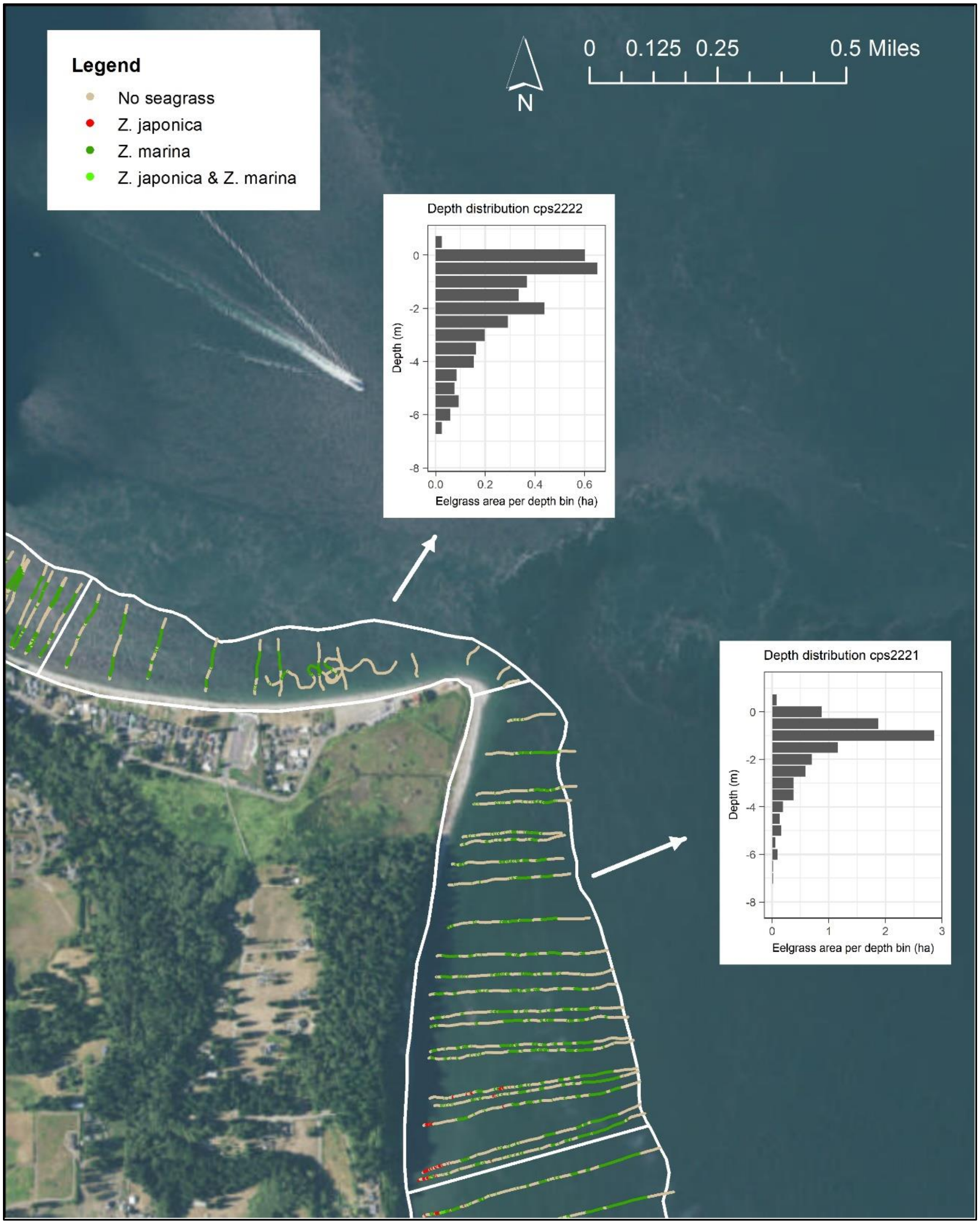


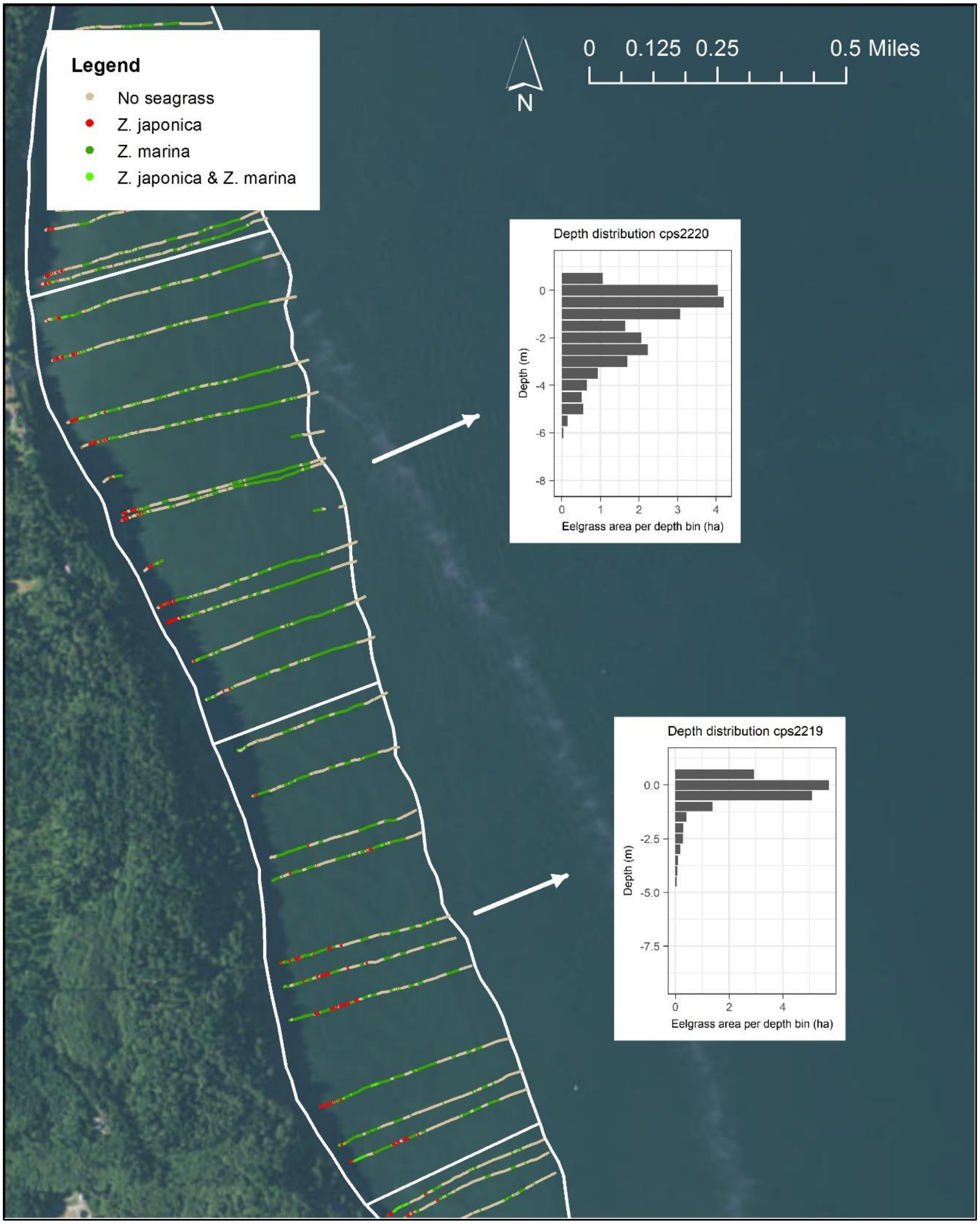
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2228
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2227
Depth (m)
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2226
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2225
Depth (m)
Eelgrass area per depth bin (ha)

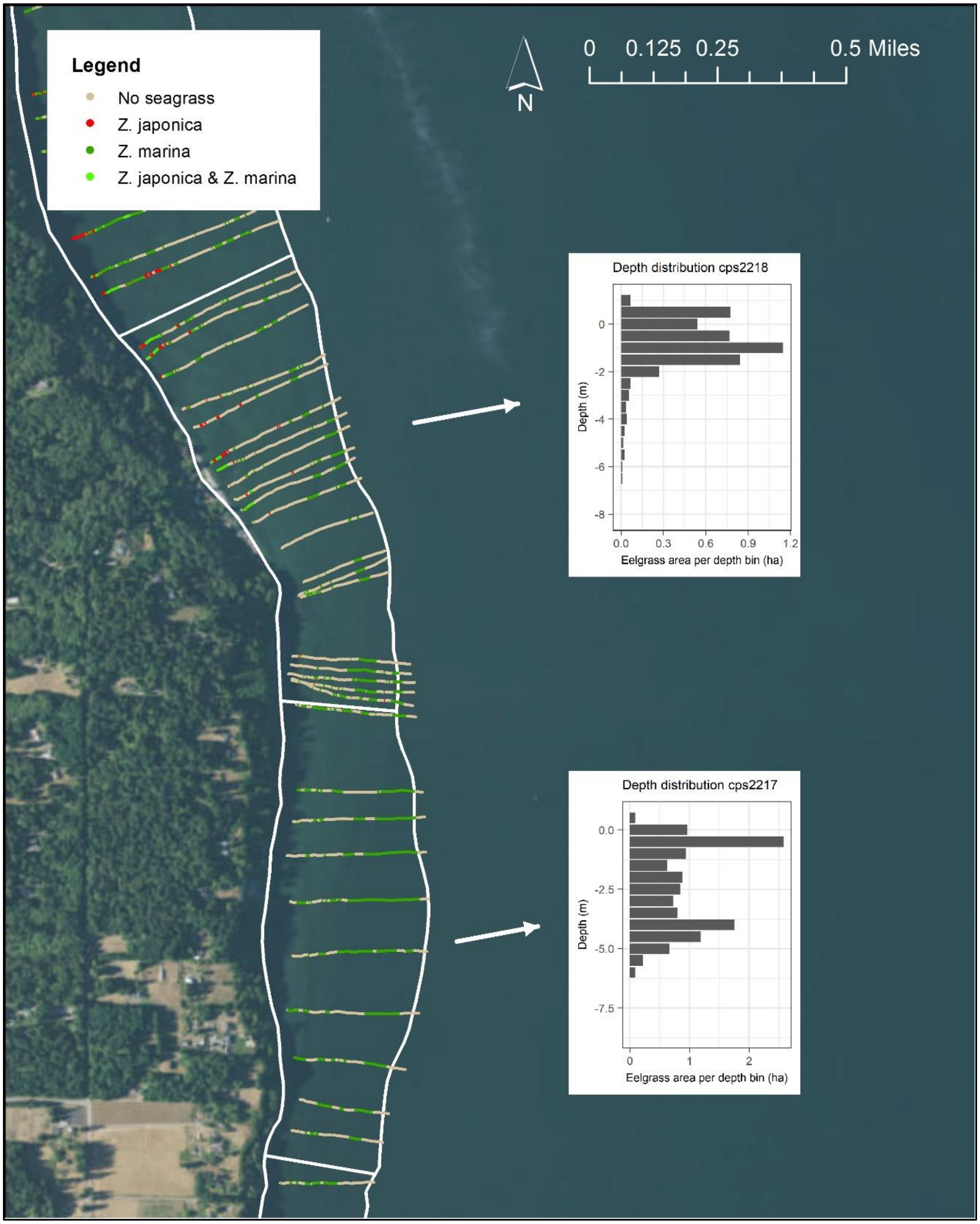


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2224
Depth (m)
0.0
-2.5
-5.0
-7.5
-10.0
0.0 0.1 0.2 0.3 0.4 0.5
Eelgrass area per depth bin (ha)
Depth distribution cps2223
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.5 1.0 1.5
Eelgrass area per depth bin (ha)

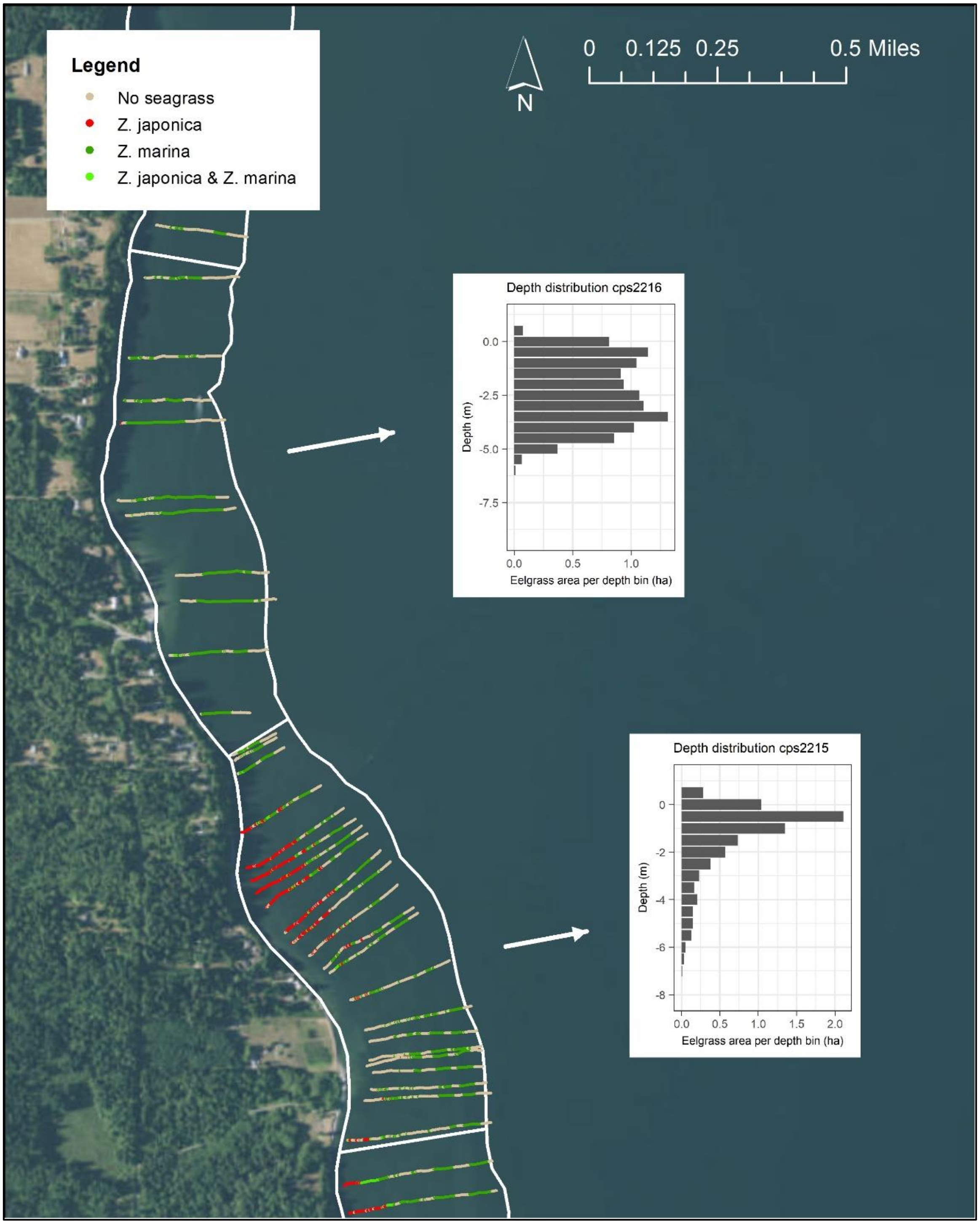

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2222
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2221
Depth (m)
Eelgrass area per depth bin (ha)



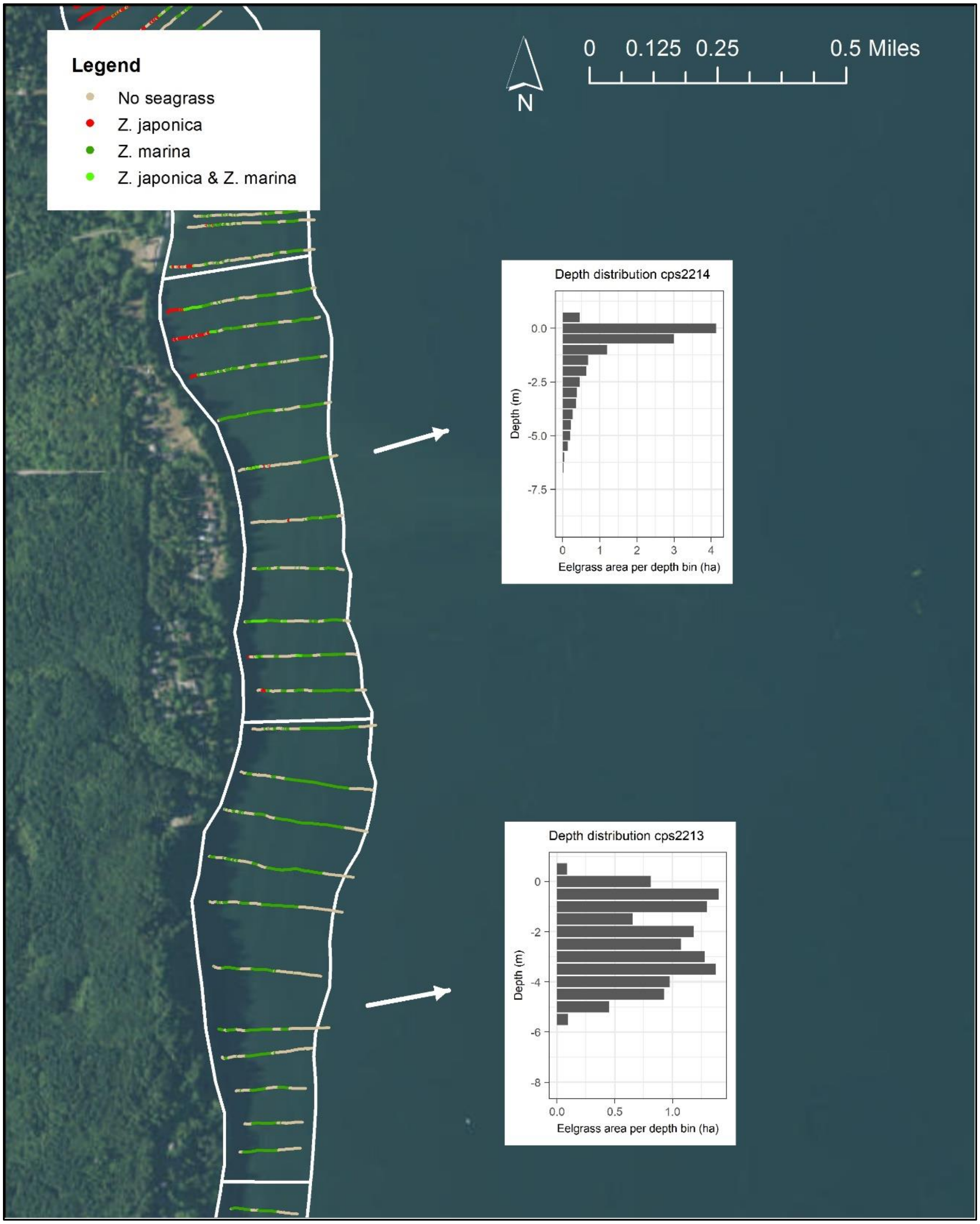
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2220
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2219
Depth (m)
Eelgrass area per depth bin (ha)

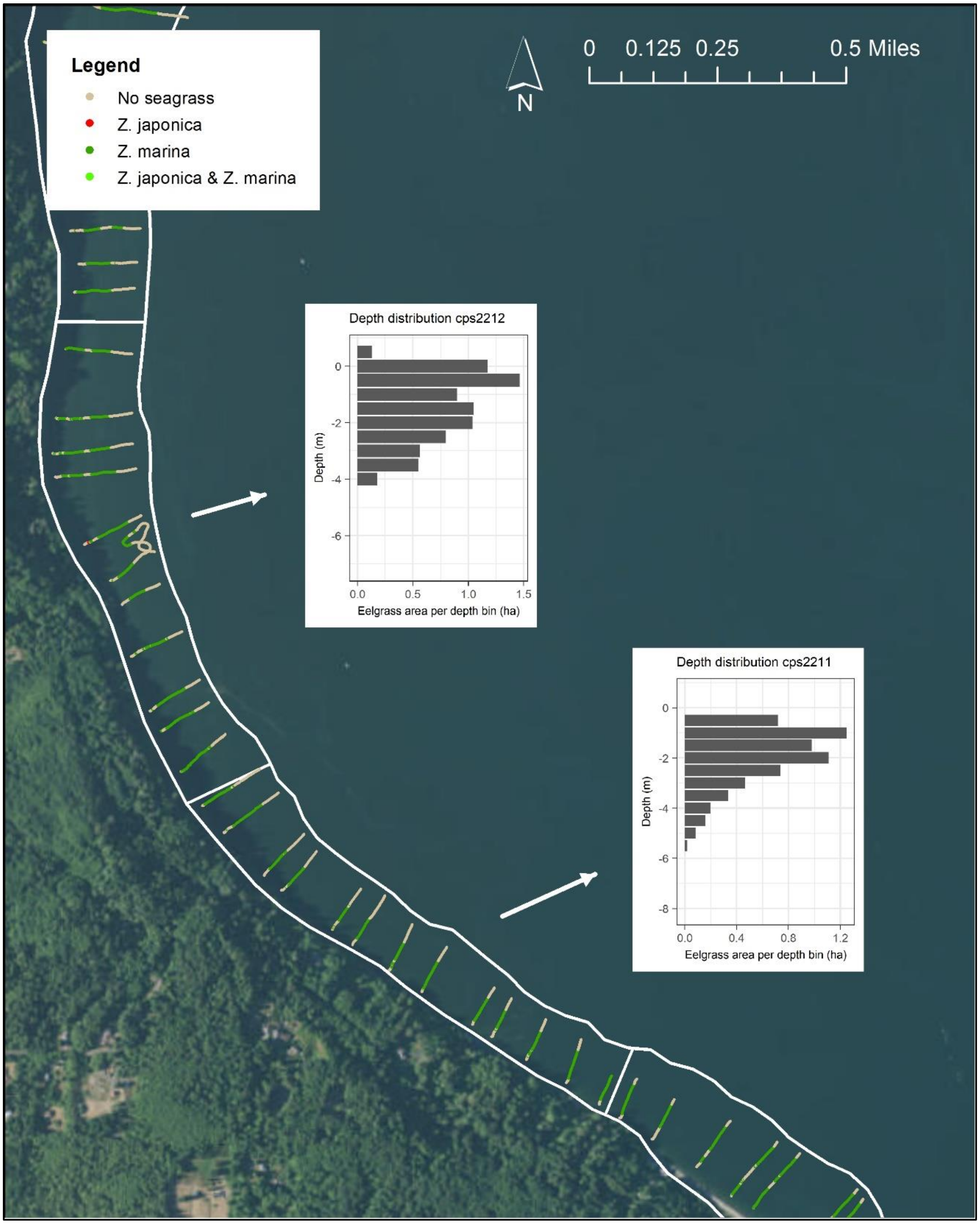


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2218
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2217
Depth (m)
Eelgrass area per depth bin (ha)

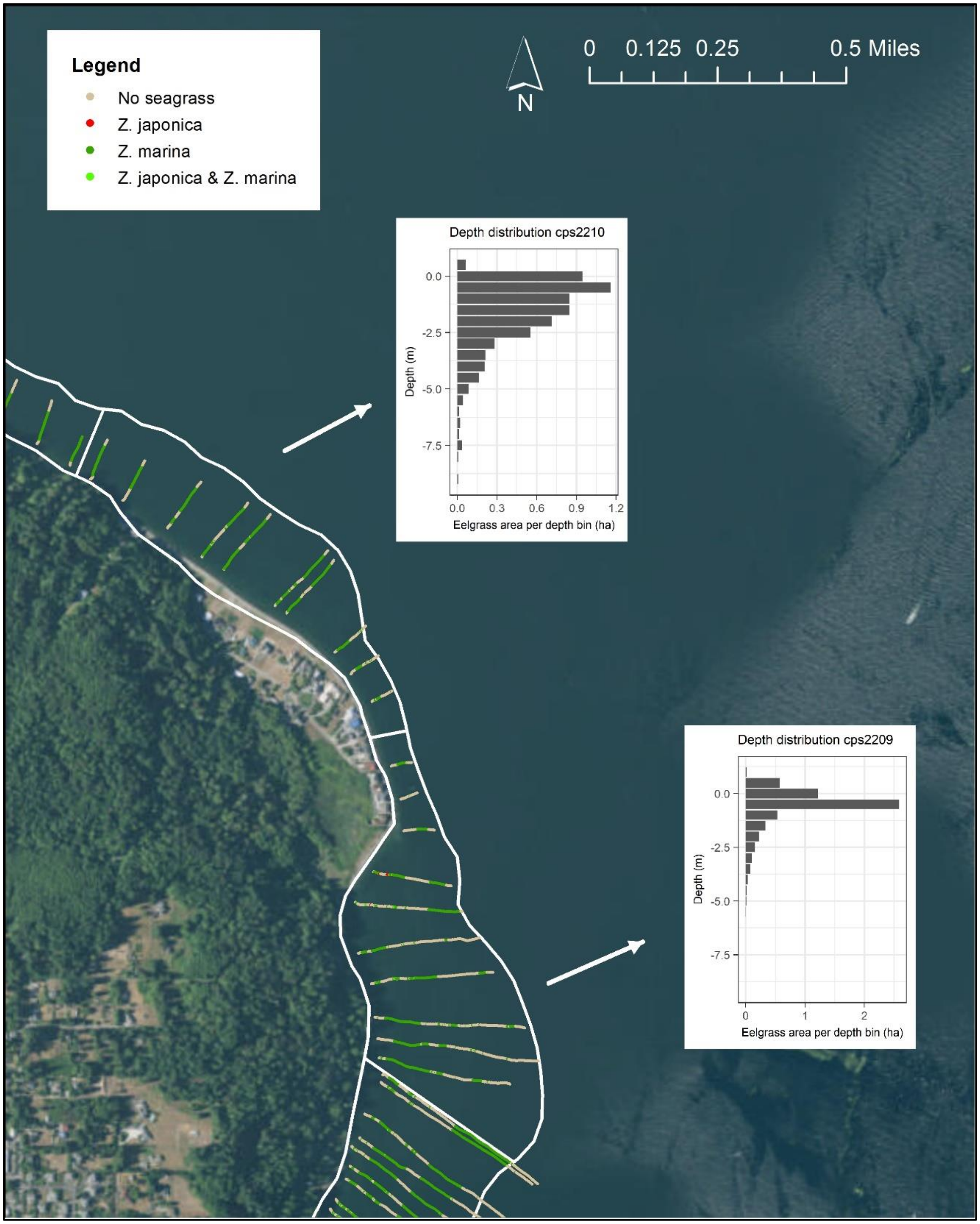


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2216
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.5 1.0
Eelgrass area per depth bin (ha)
Depth distribution cps2215
Depth (m)
0
-2
-4
-6
-8
0.0 0.5 1.0 1.5 2.0
Eelgrass area per depth bin (ha)

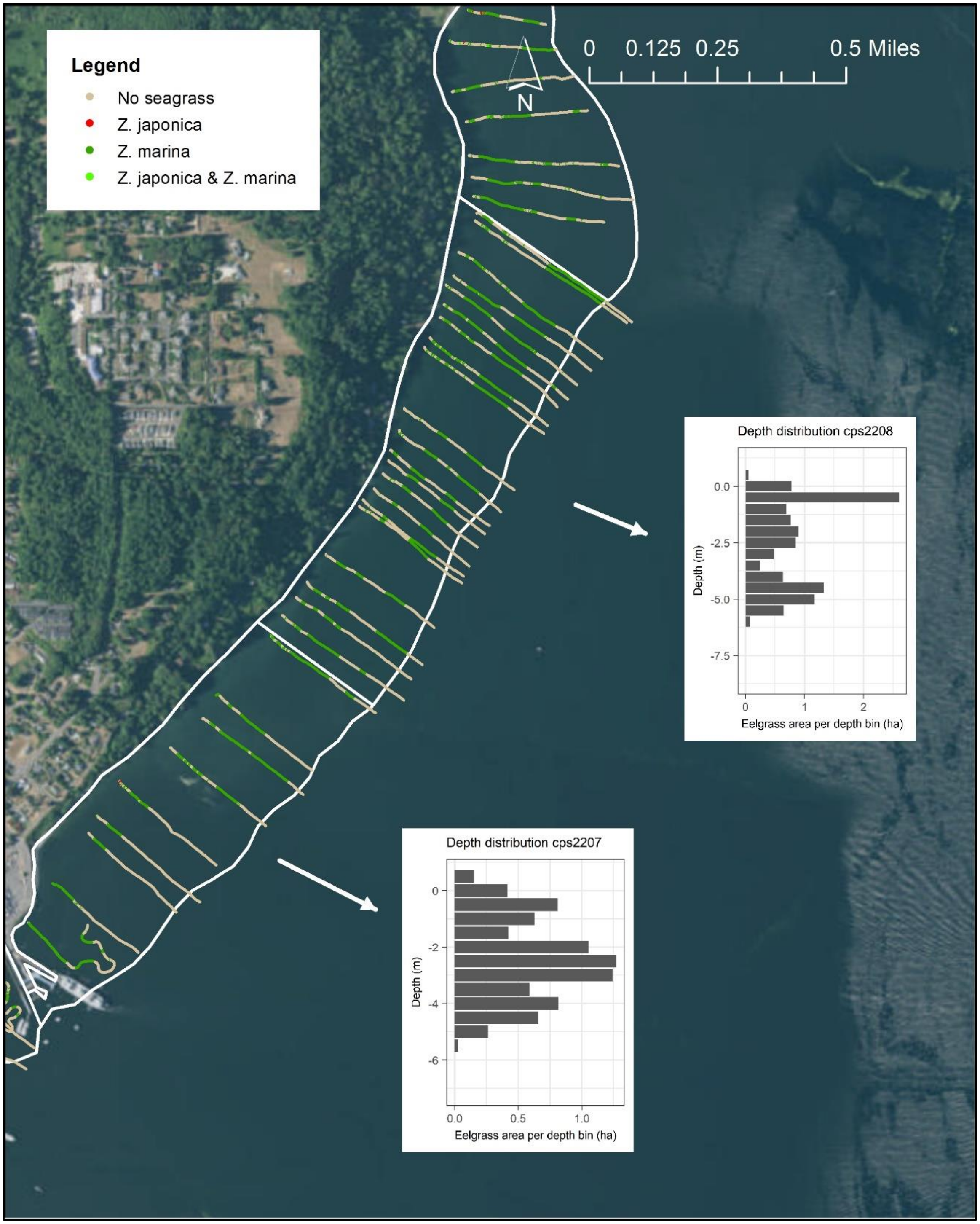

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2214
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2213
Depth (m)
Eelgrass area per depth bin (ha)

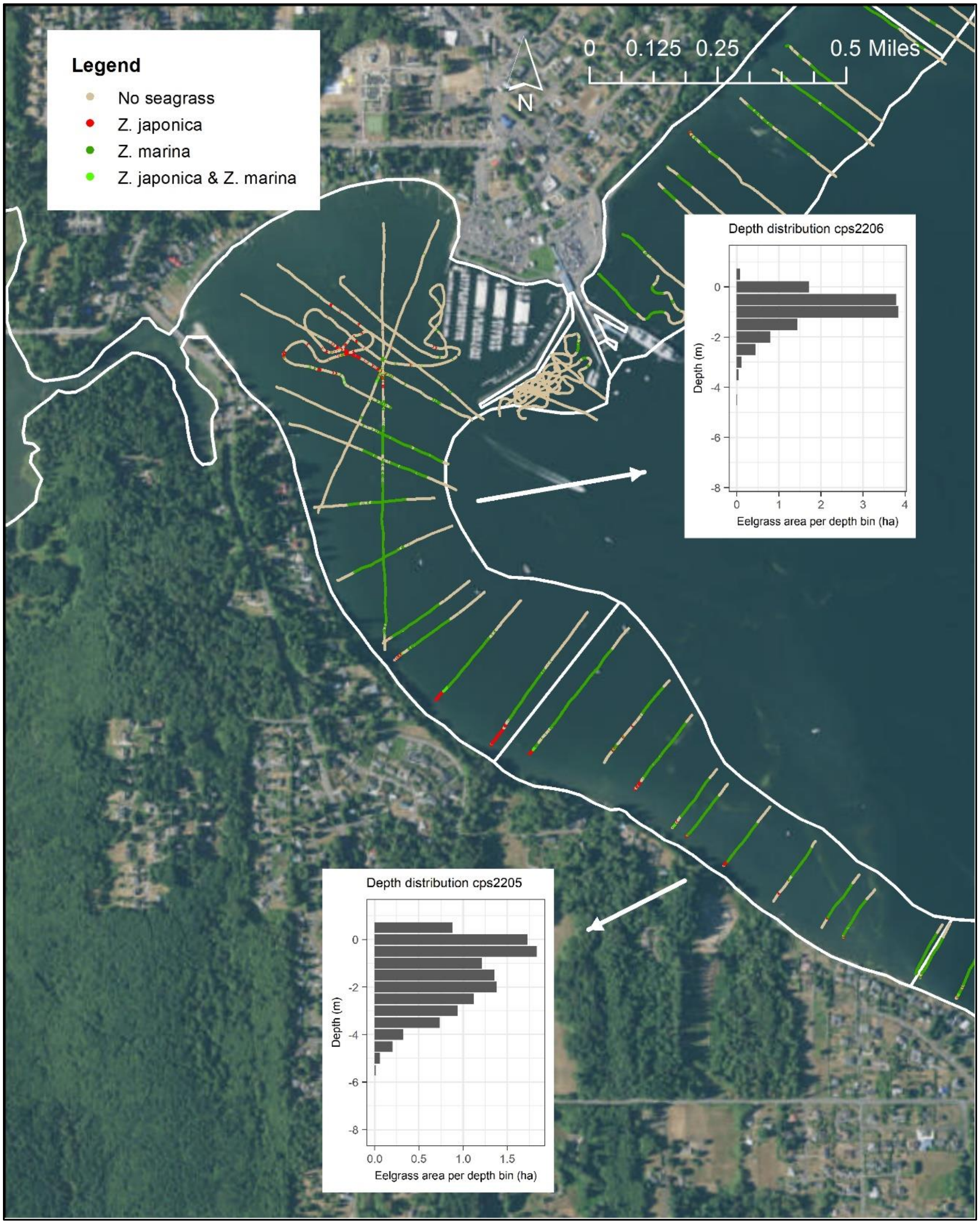


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution cps2212
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2211
Depth (m)
Eelgrass area per depth bin (ha)

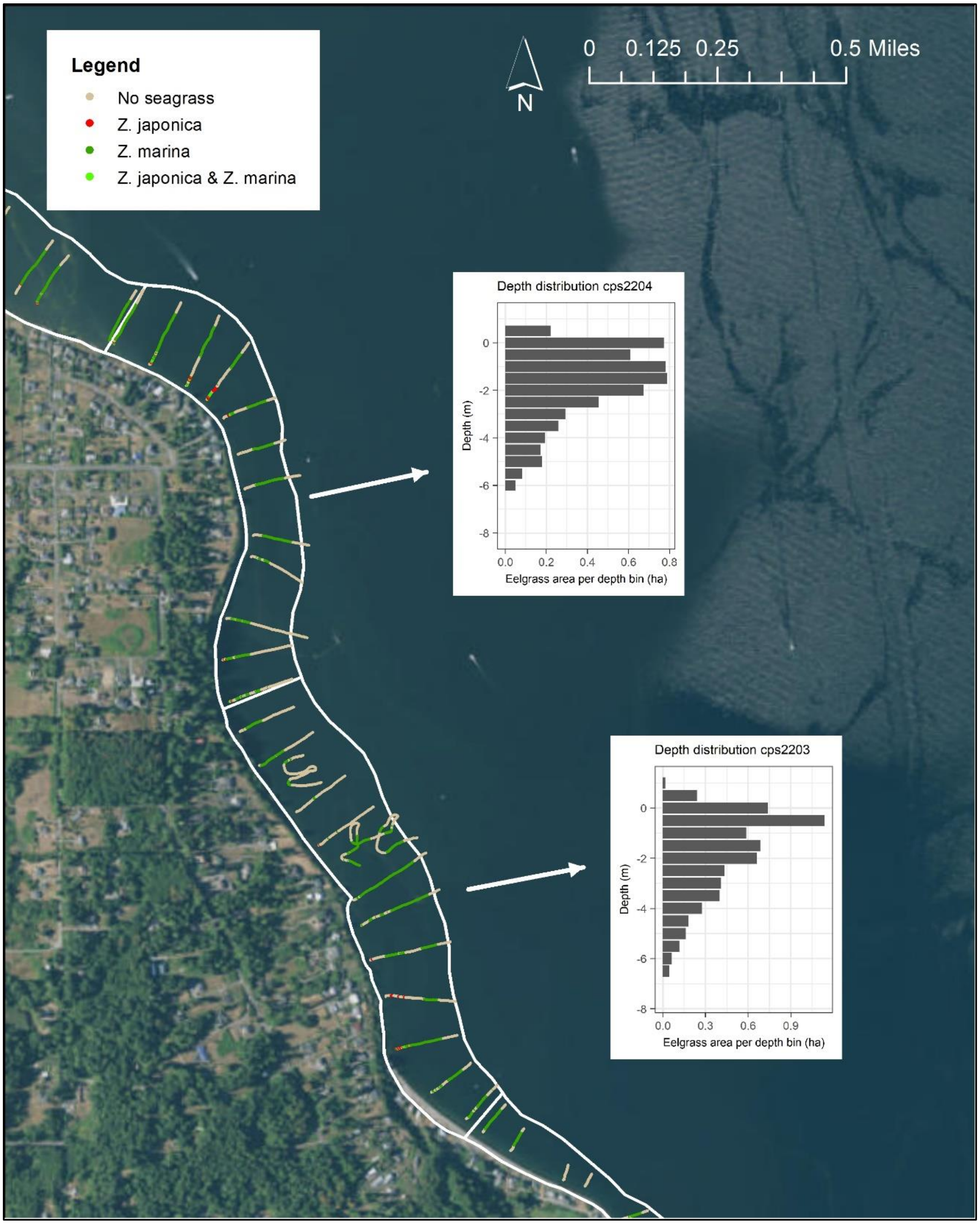


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2210
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2209
Depth (m)
Eelgrass area per depth bin (ha)

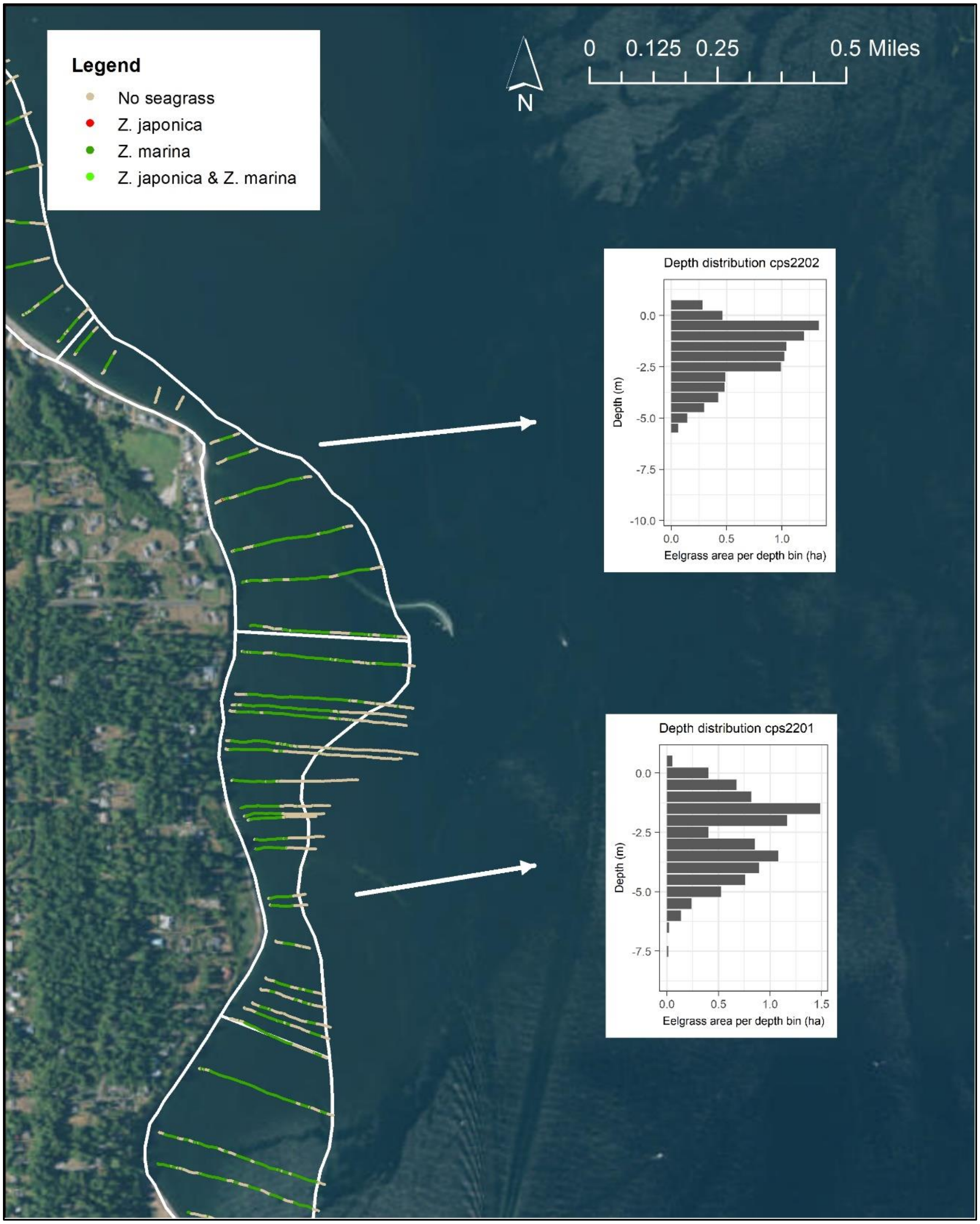

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
Depth distribution cps2208
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2207
Depth (m)
Eelgrass area per depth bin (ha)

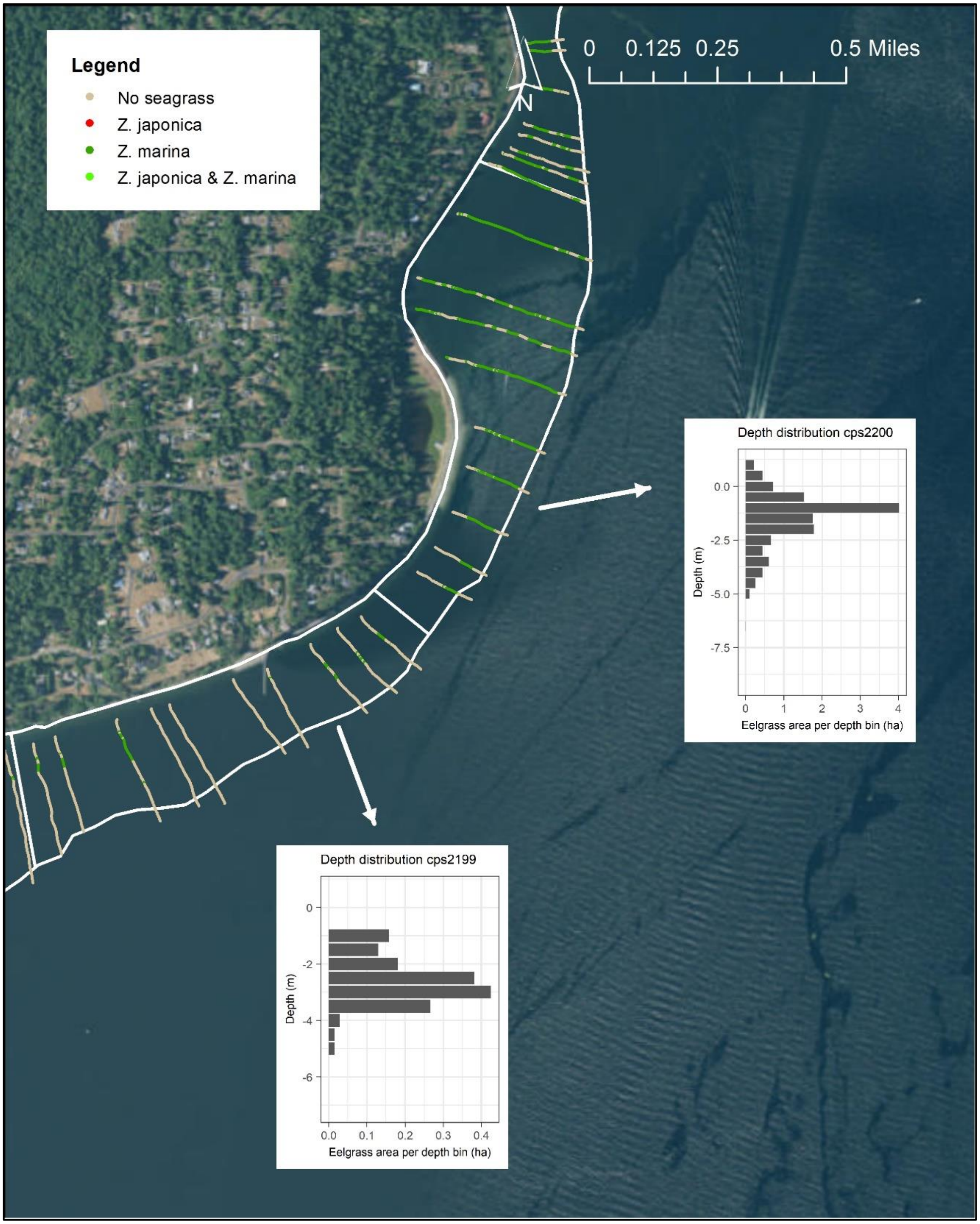


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
Depth distribution cps2206
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2205
Depth (m)
Eelgrass area per depth bin (ha)

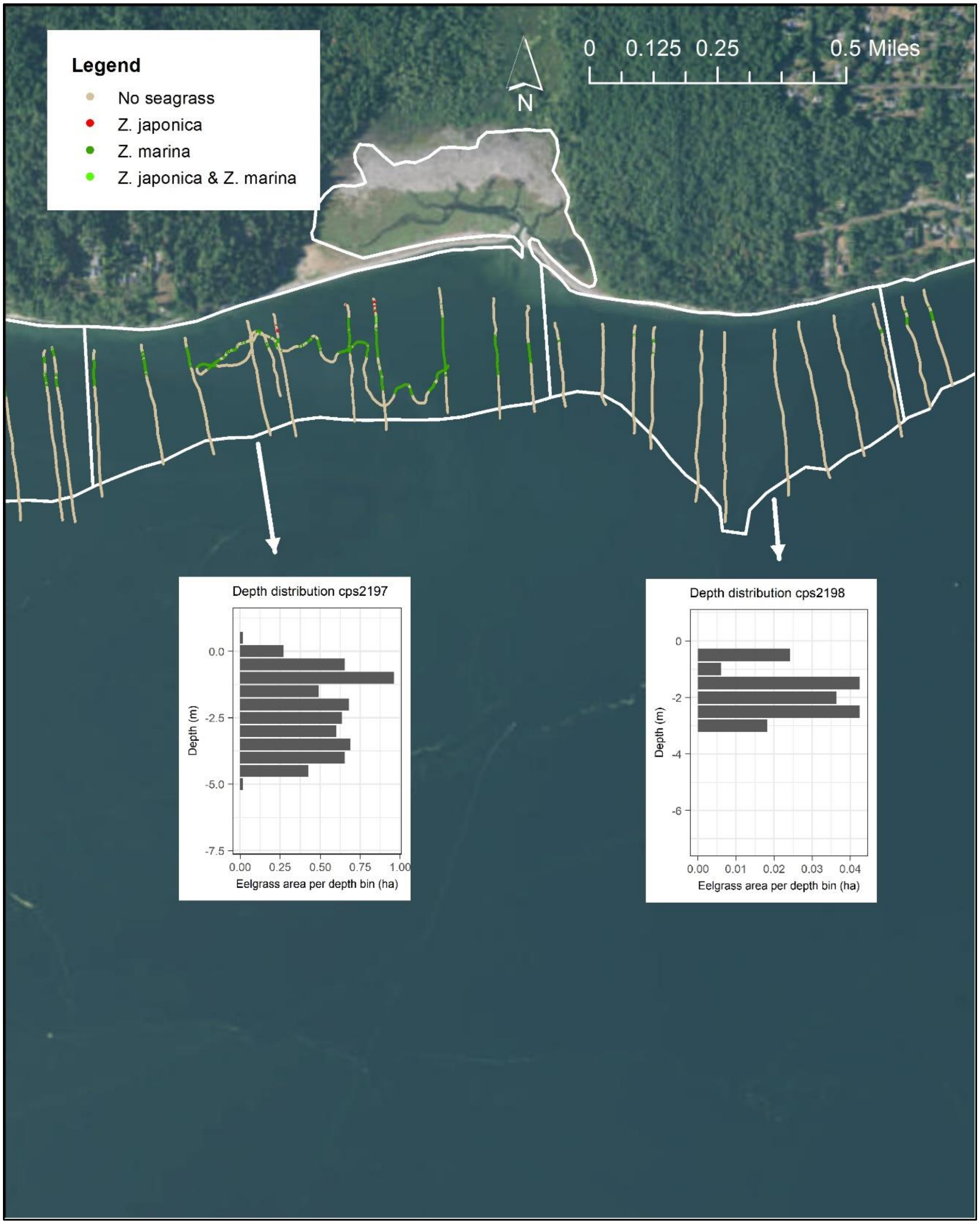


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2204
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2203
Depth (m)
Eelgrass area per depth bin (ha)

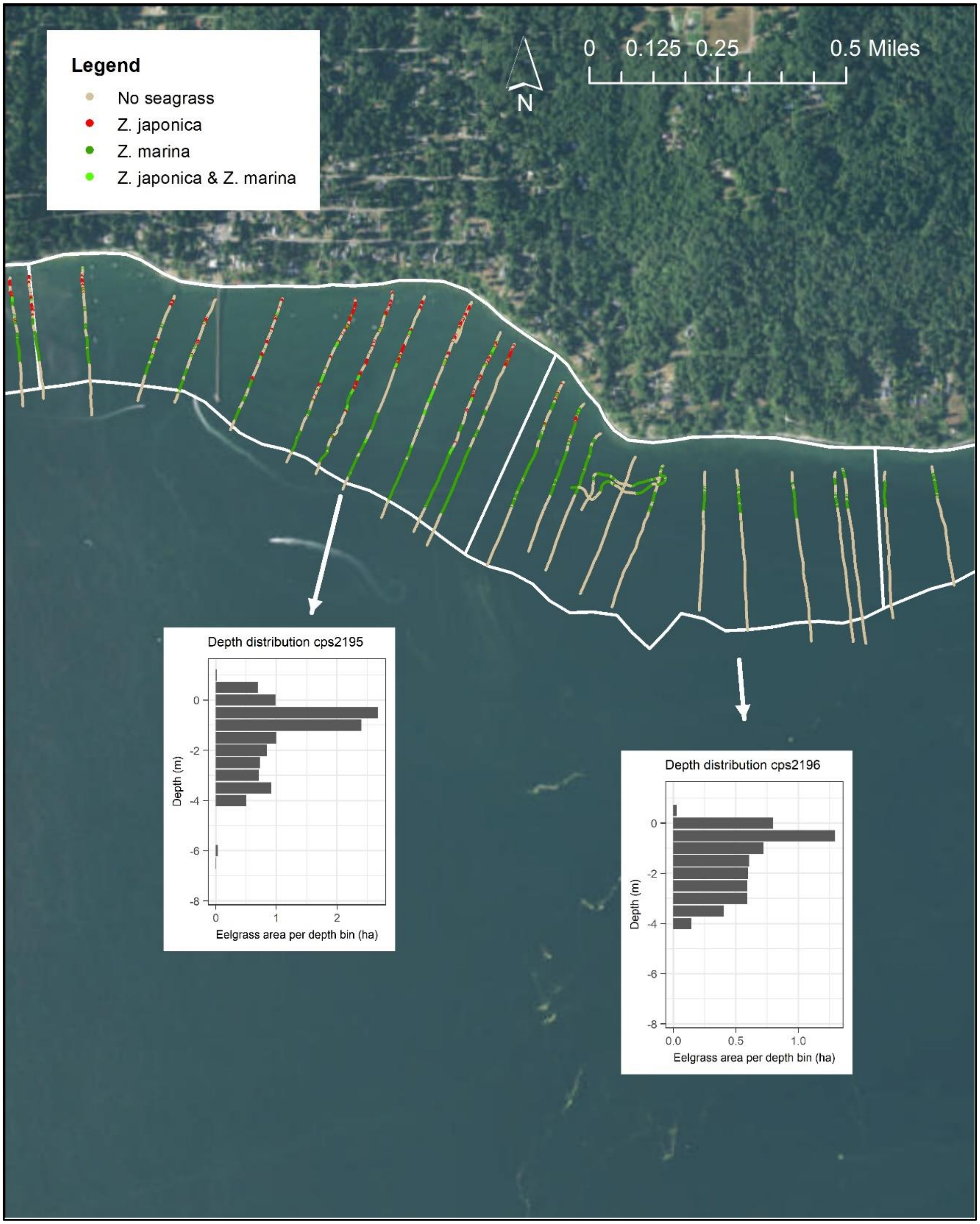

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2202
Depth (m)
0.0
-2.5
-5.0
-7.5
-10.0
0.0 0.5 1.0
Eelgrass area per depth bin (ha)
Depth distribution cps2201
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.5 1.0 1.5
Eelgrass area per depth bin (ha)

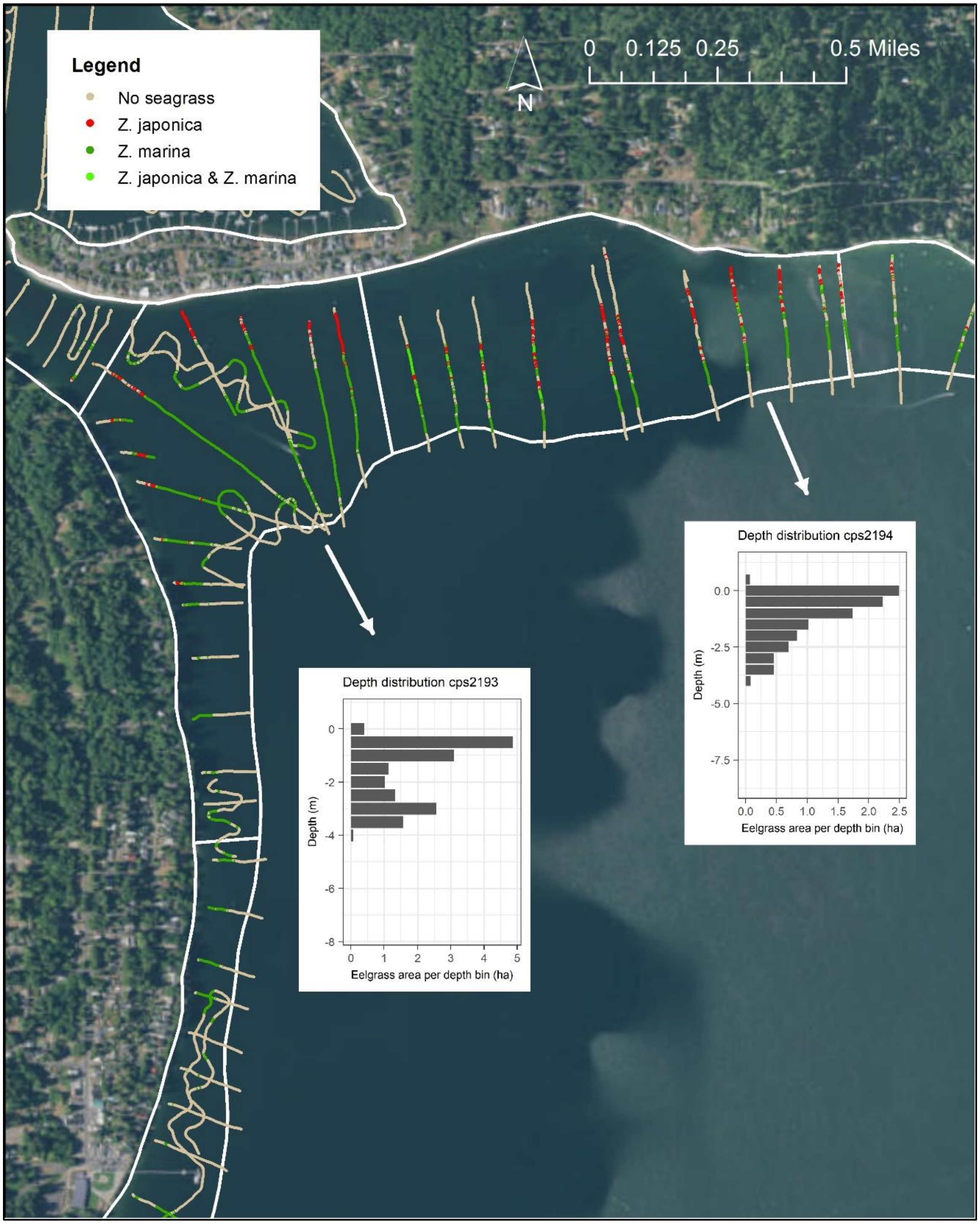


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
Depth distribution cps2200
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2199
Depth (m)
Eelgrass area per depth bin (ha)

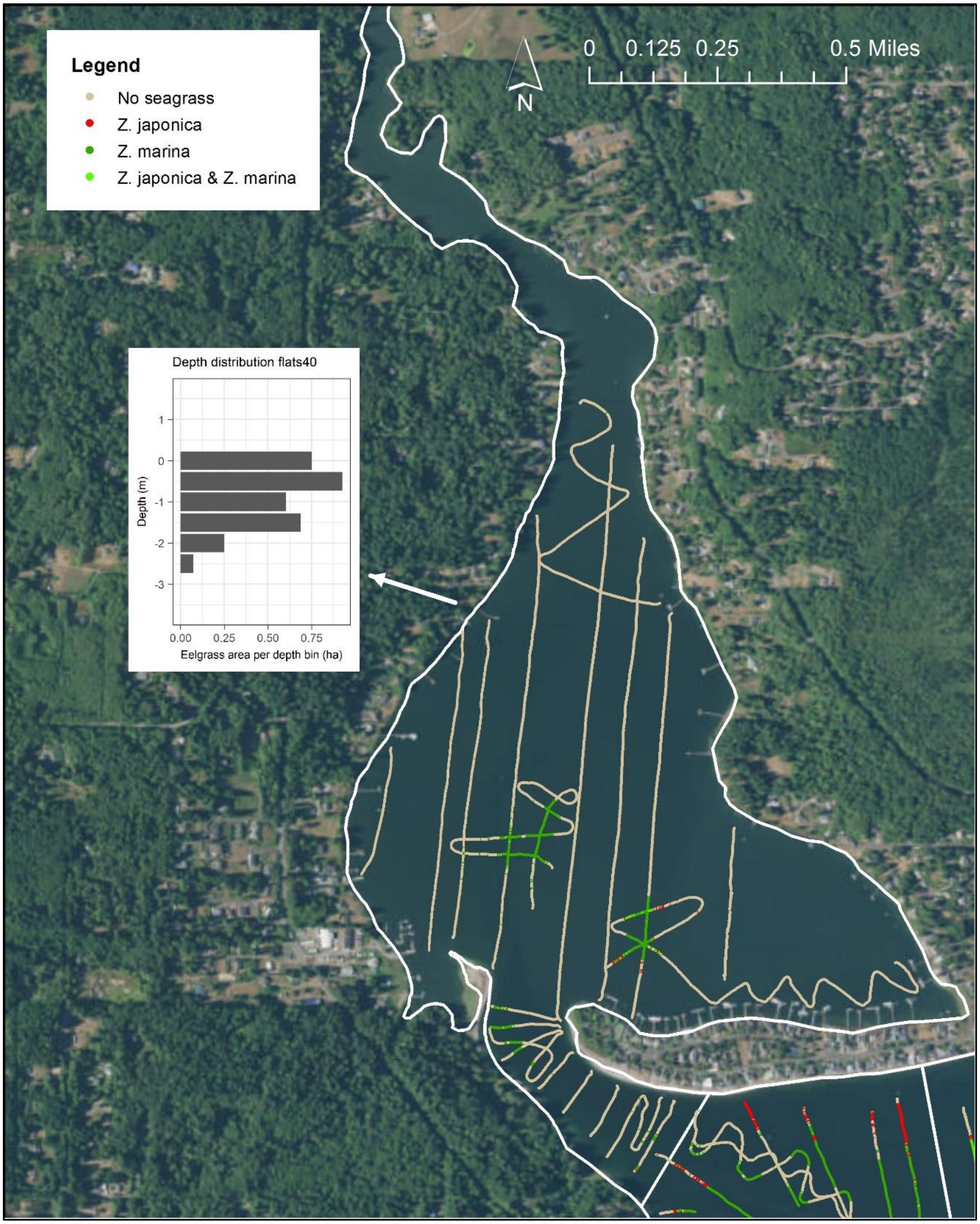


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2197
Depth (m)
0.0
-2.5
-5.0
-7.5
0.00 0.25 0.50 0.75 1.00
Eelgrass area per depth bin (ha)
Depth distribution cps2198
Depth (m)
0
-2
-4
-6
0.00 0.01 0.02 0.03 0.04
Eelgrass area per depth bin (ha)

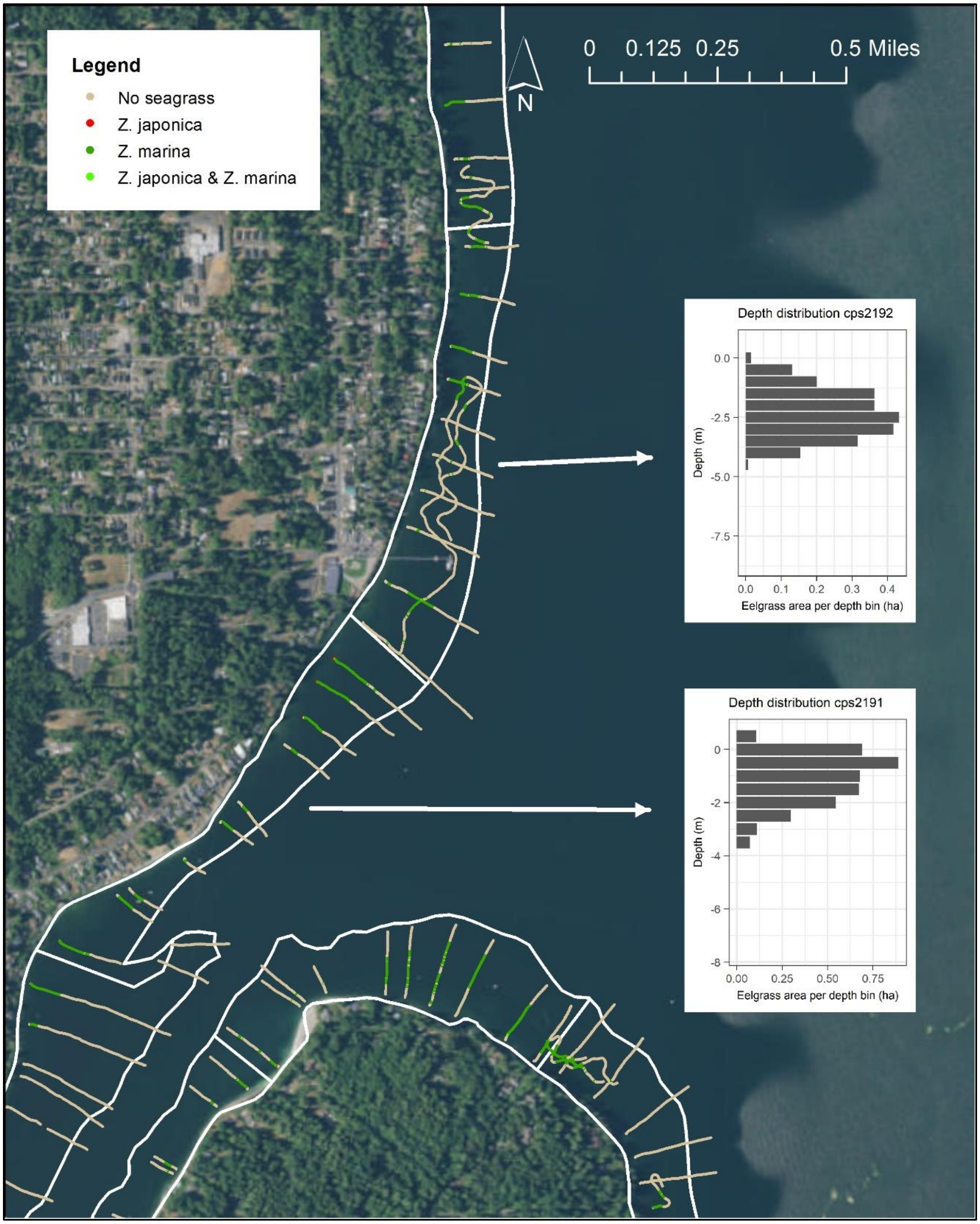

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution cps2195
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2196
Depth (m)
Eelgrass area per depth bin (ha)

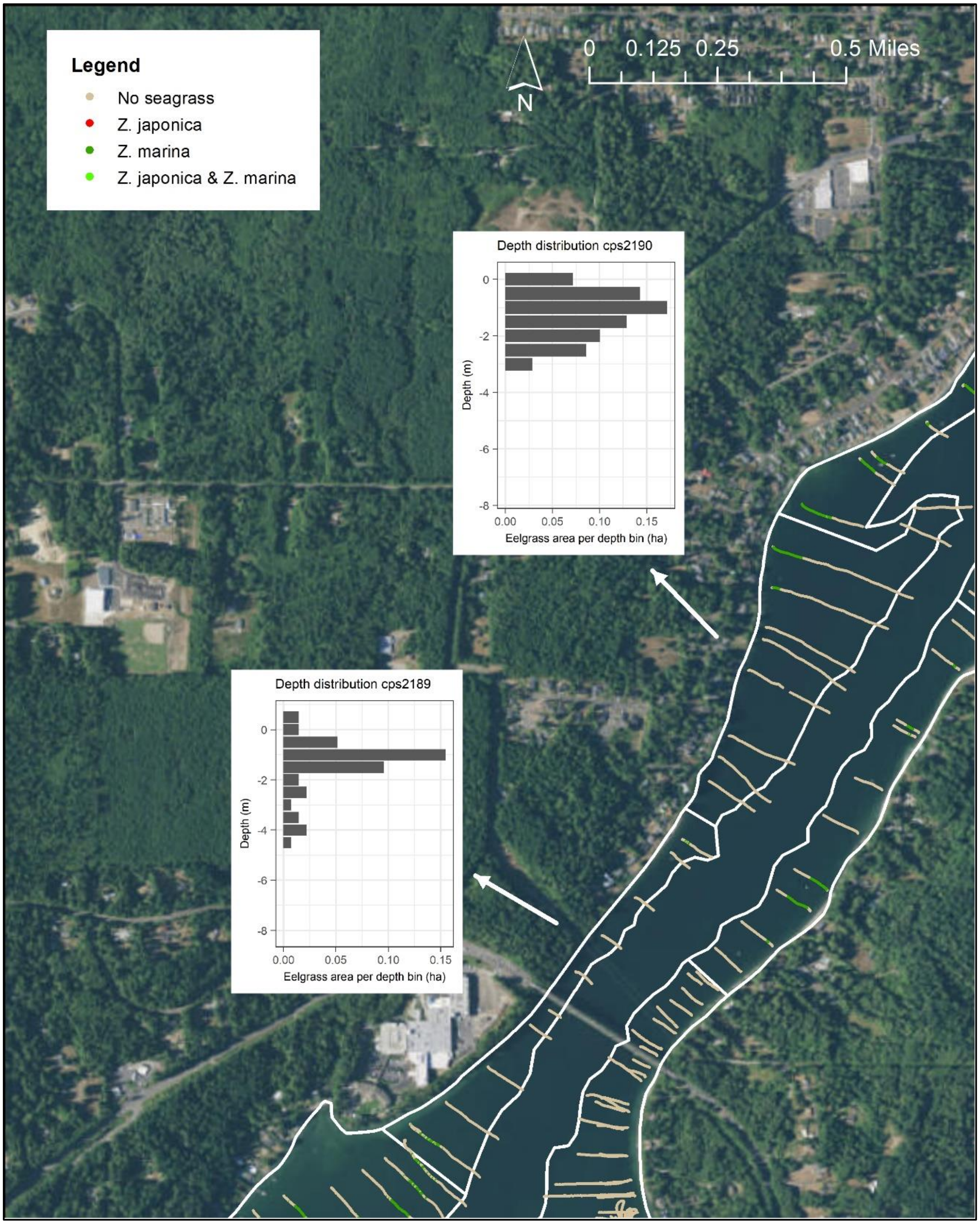


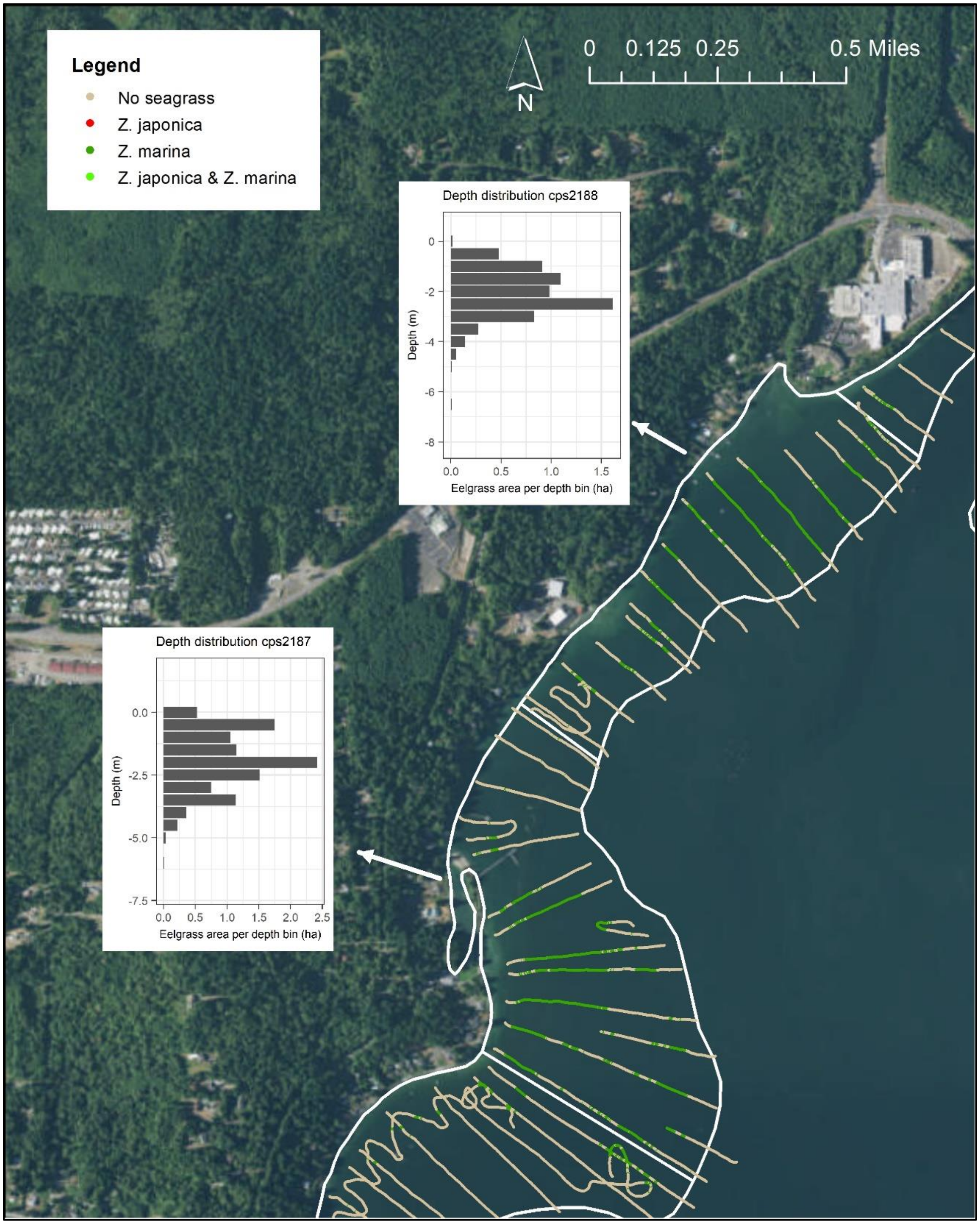
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2194
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.5 1.0 1.5 2.0 2.5
Eelgrass area per depth bin (ha)
Depth distribution cps2193
Depth (m)
0
-2
-4
-6
-8
0 1 2 3 4 5
Eelgrass area per depth bin (ha)

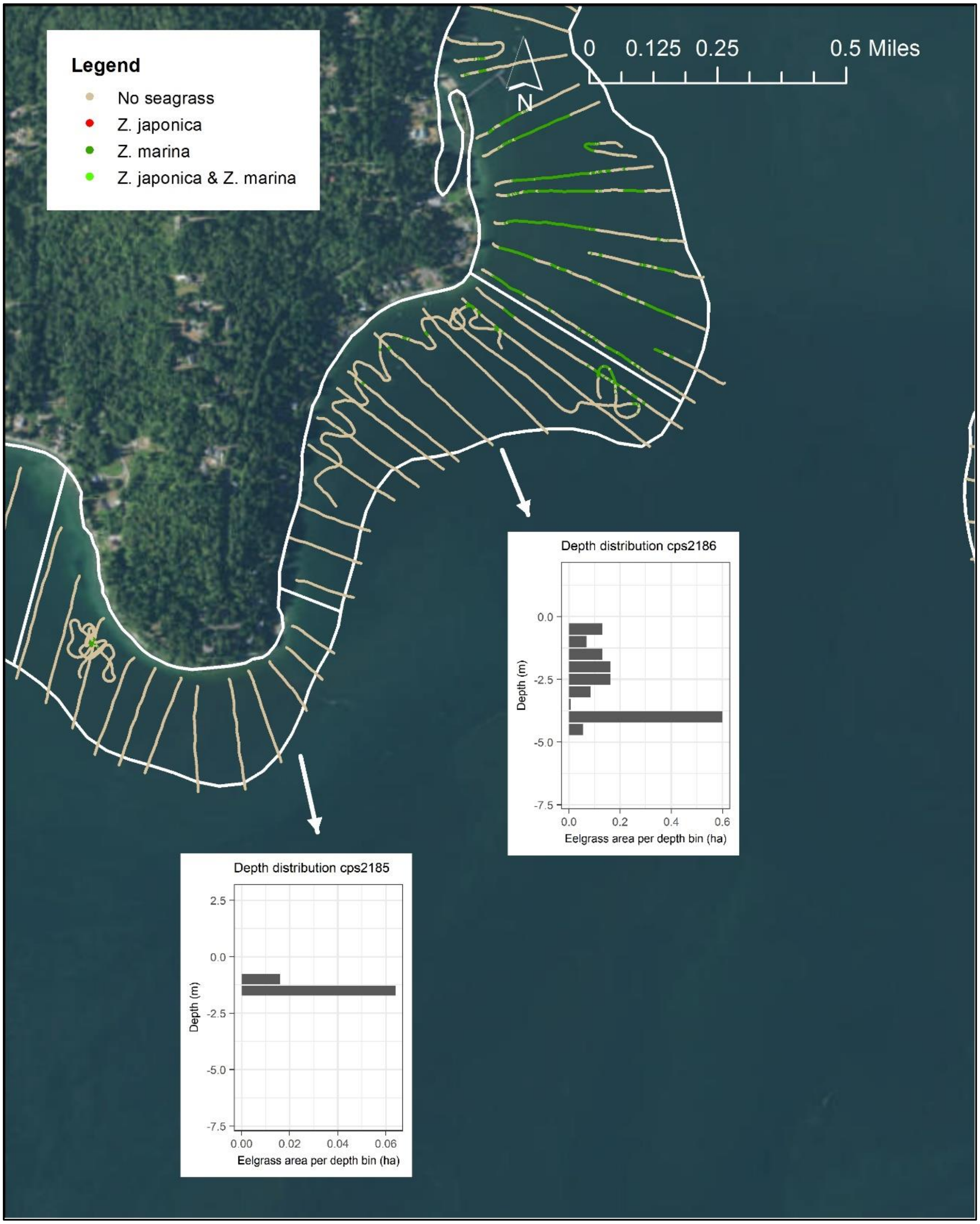


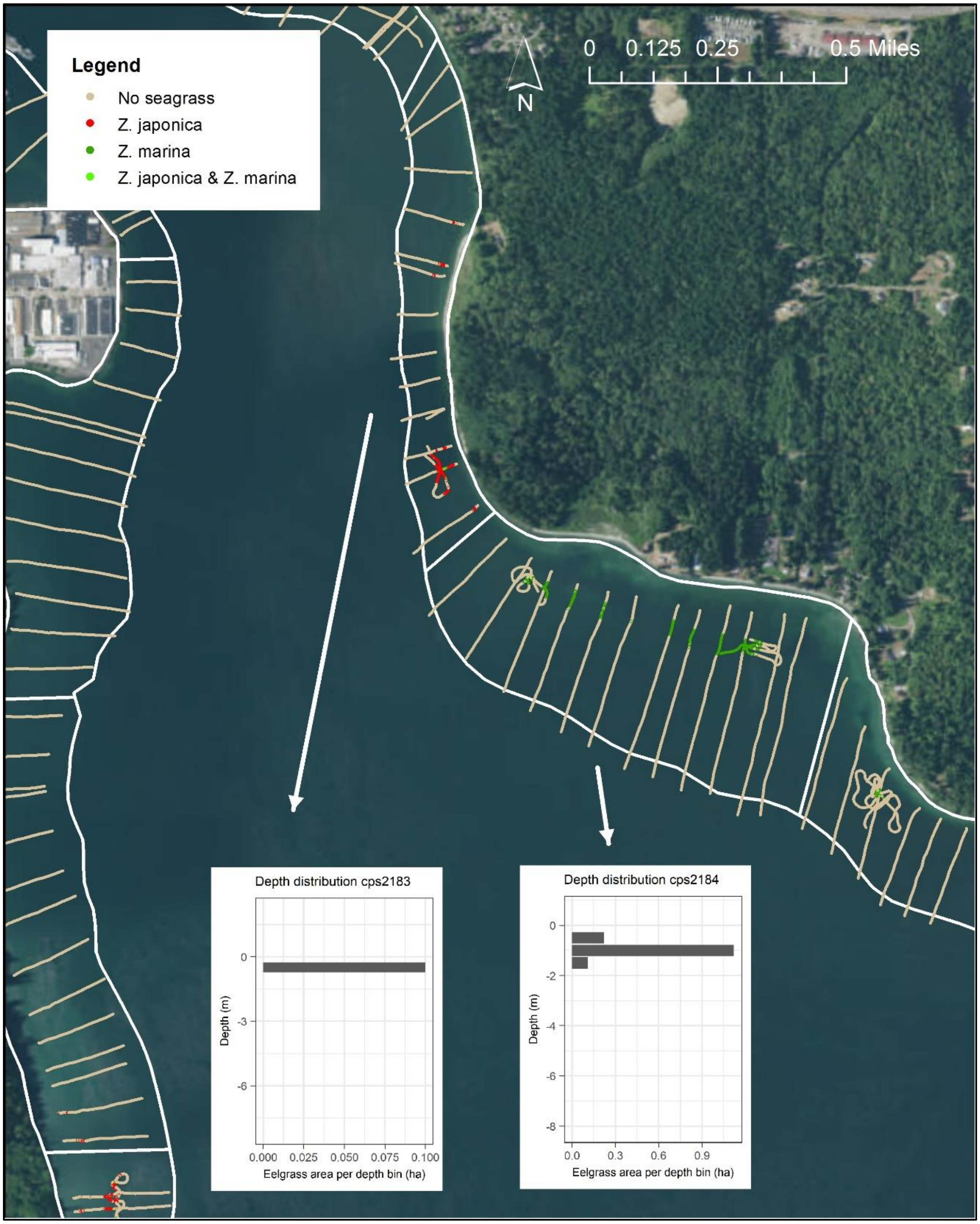
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution flats40
Depth (m)
1
0
-1
-2
-3
0.00
0.25
0.50
0.75
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2192
0.0
-2.5
-5.0
-7.5
Depth (m)
0.0 0.1 0.2 0.3 0.4
Eelgrass area per depth bin (ha)
Depth distribution cps2191
0
-2
-4
-6
-8
Depth (m)
0.00 0.25 0.50 0.75
Eelgrass area per depth bin (ha)

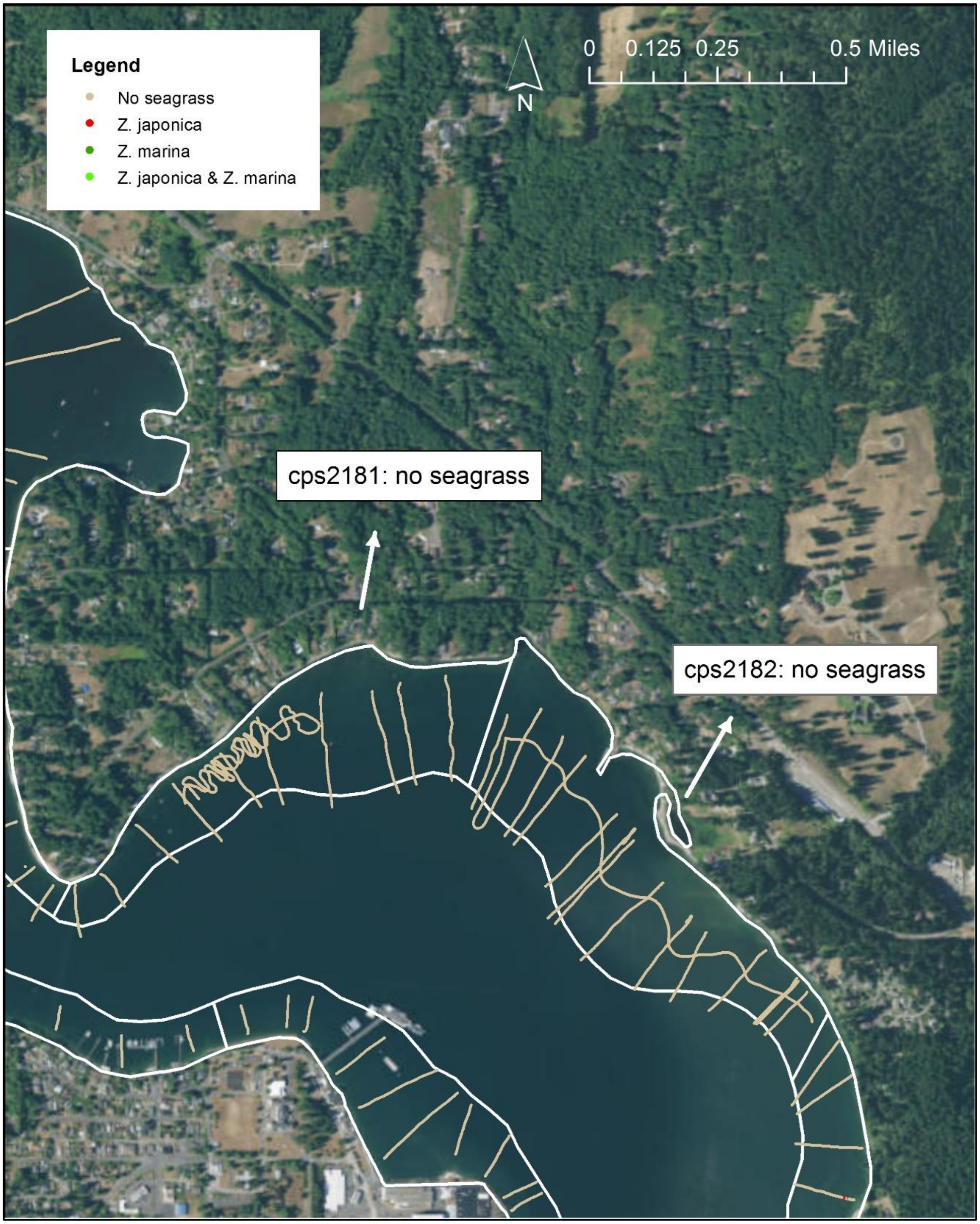

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2190
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2189
Depth (m)
Eelgrass area per depth bin (ha)

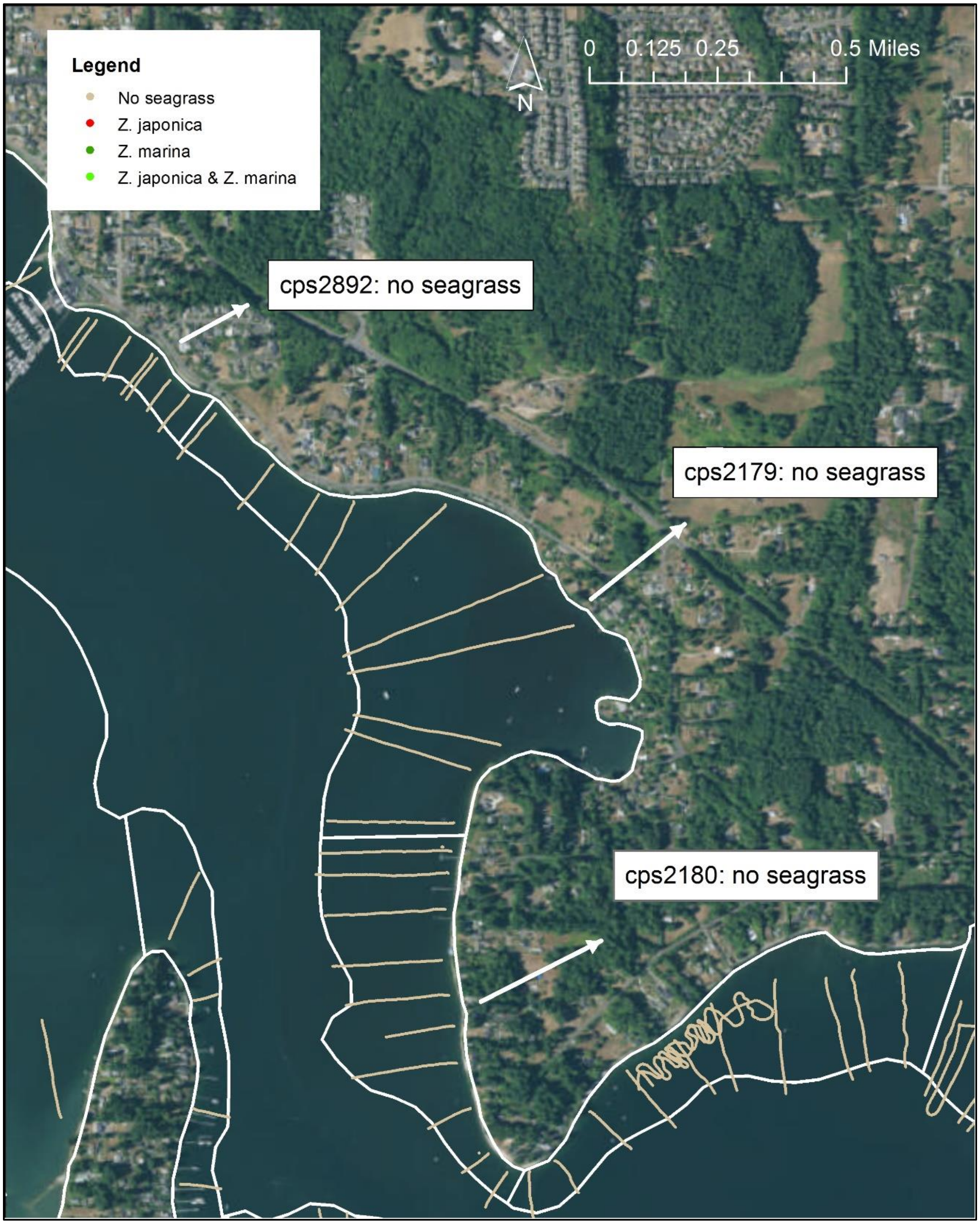

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2188
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2187
Depth (m)
Eelgrass area per depth bin (ha)

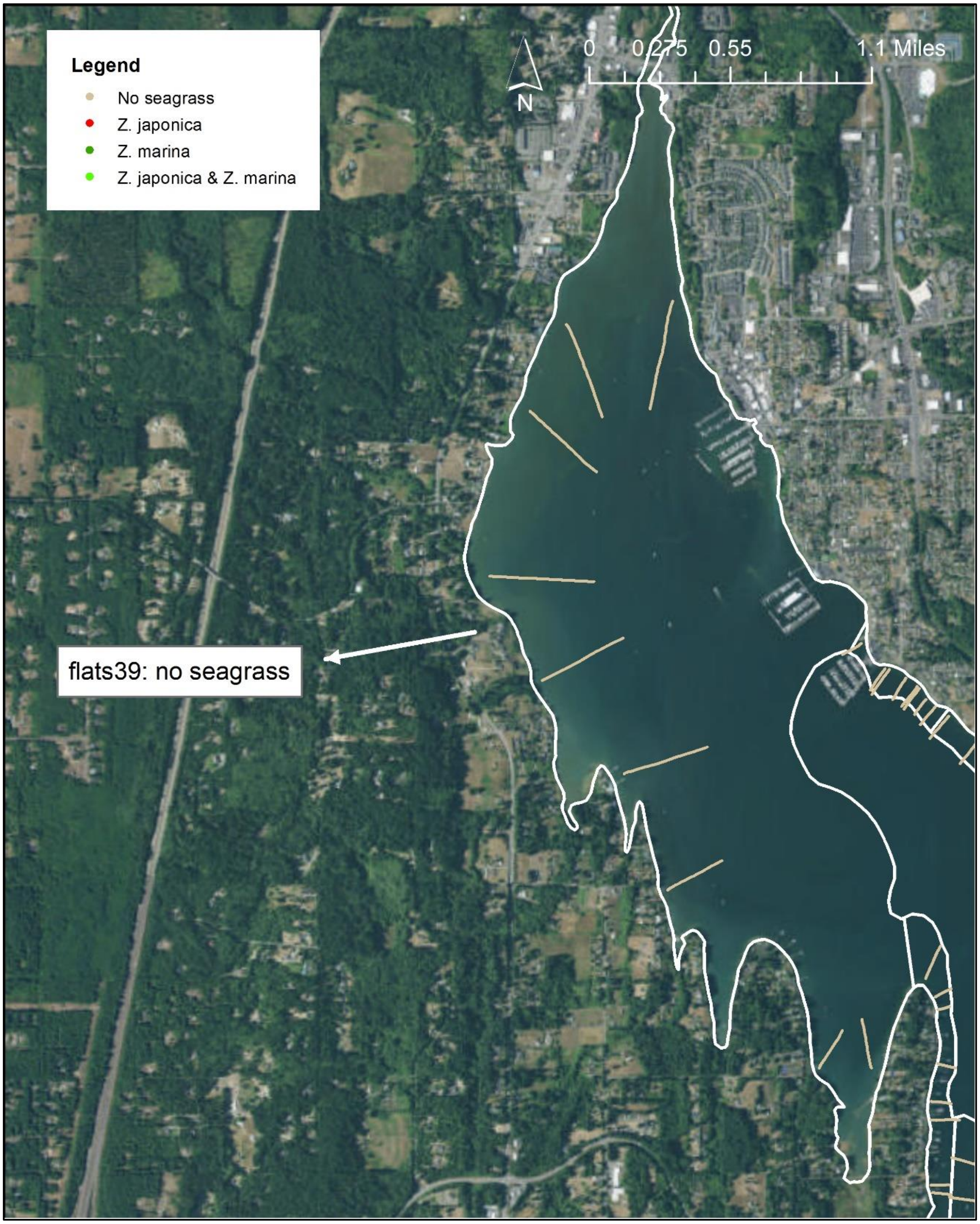

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2186
Depth (m)
Eelgrass area per depth bin (ha)
0.0
-2.5
-5.0
-7.5
0.0 0.2 0.4 0.6
Depth distribution cps2185
2.5
0.00 0.02 0.04 0.06

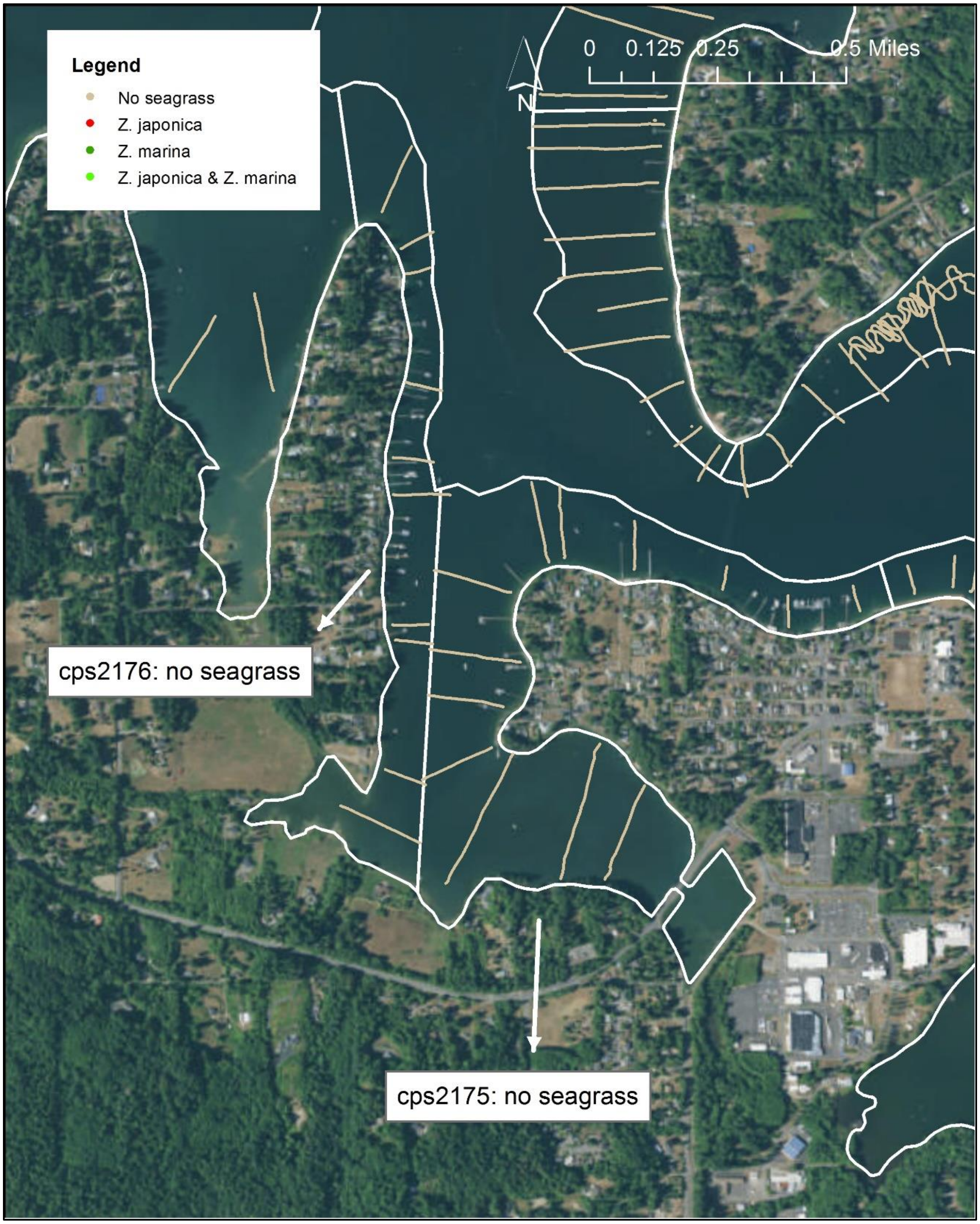


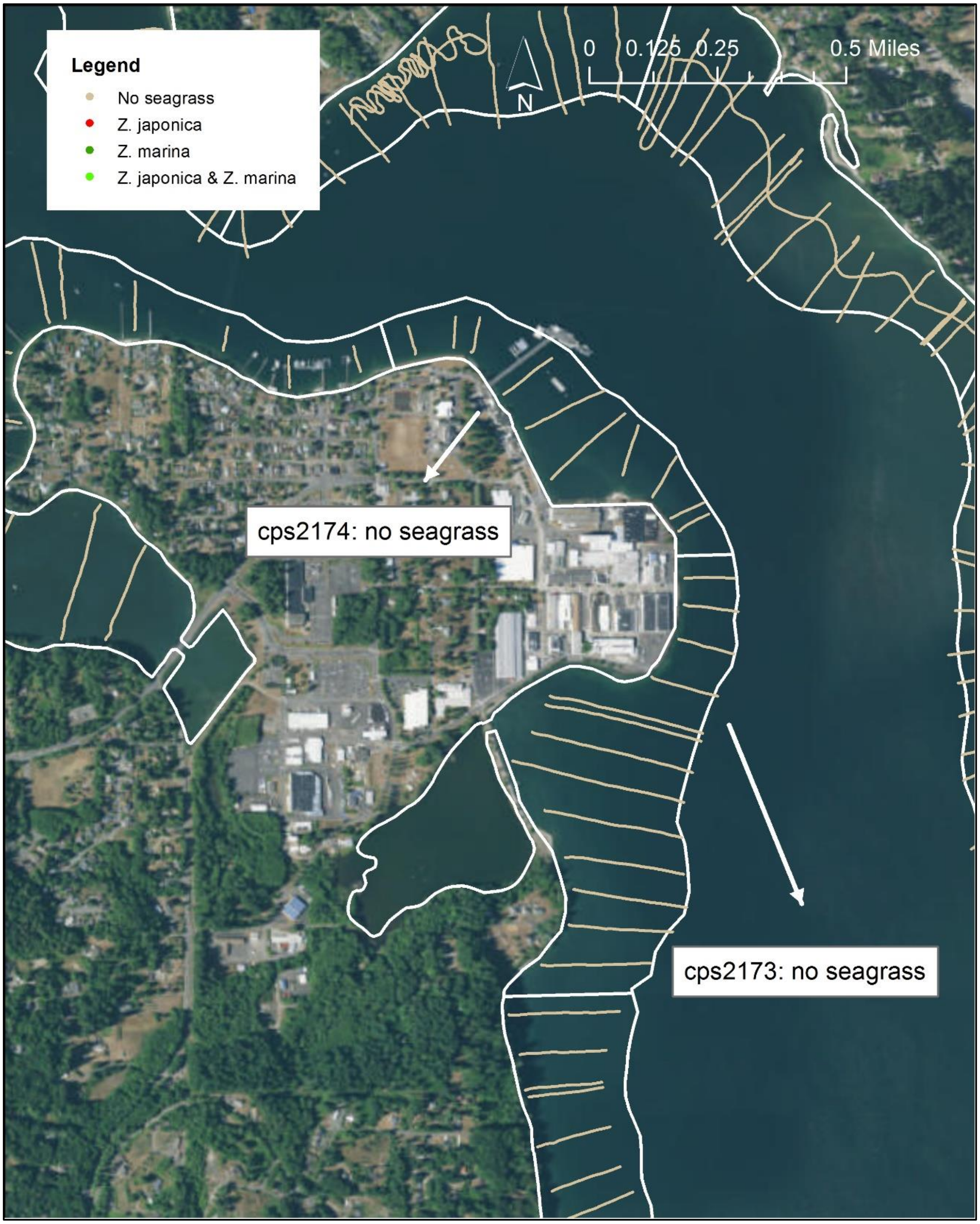
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution cps2183
Depth (m)
0
-3
-6
0.000
0.025
0.050
0.075
0.100
Eelgrass area per depth bin (ha)
Depth distribution cps2184
Depth (m)
0
-2
-4
-6
-8
0.0
0.3
0.6
0.9
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2181: no seagrass
cps2182: no seagrass

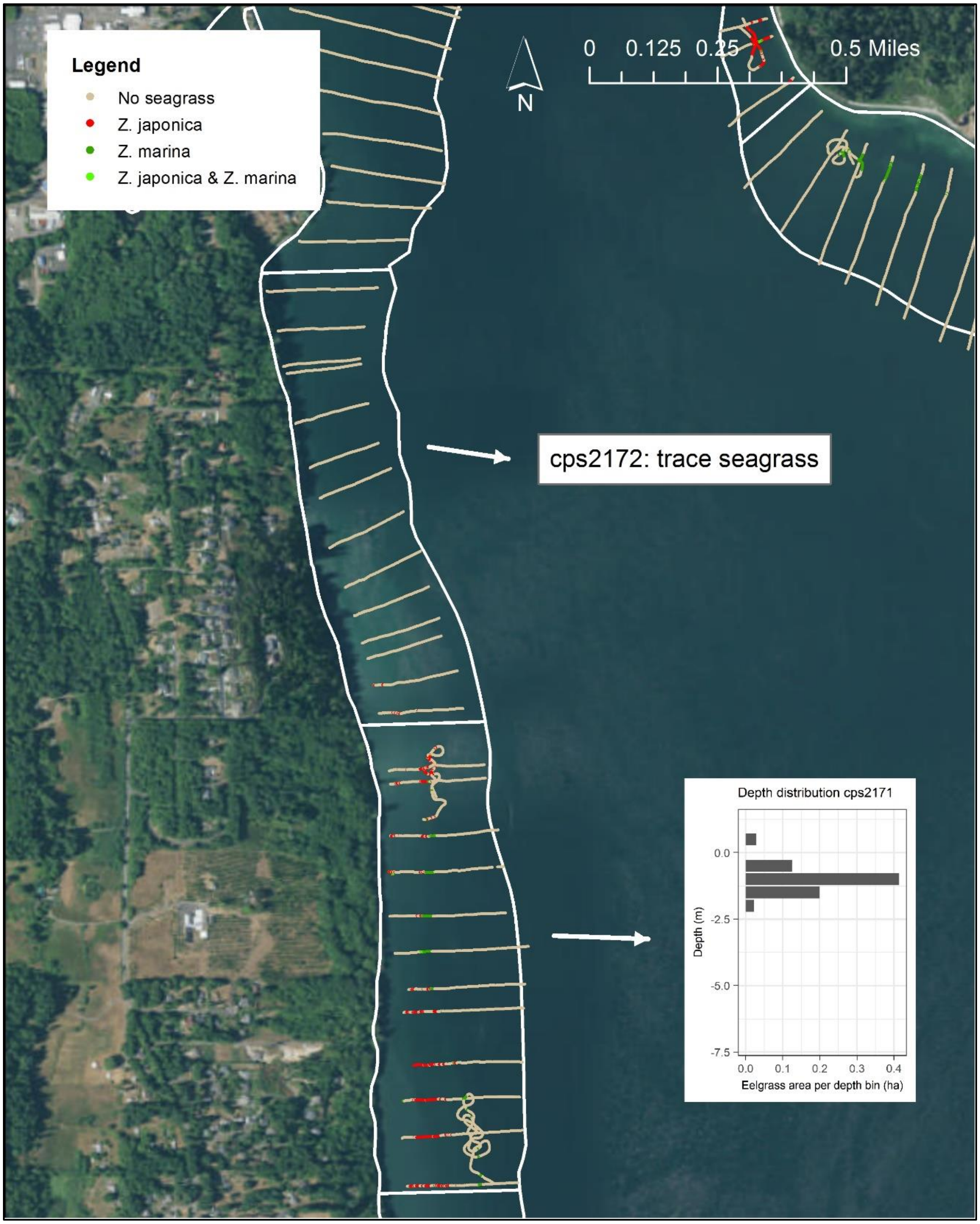

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2892: no seagrass
cps2179: no seagrass
cps2180: no seagrass

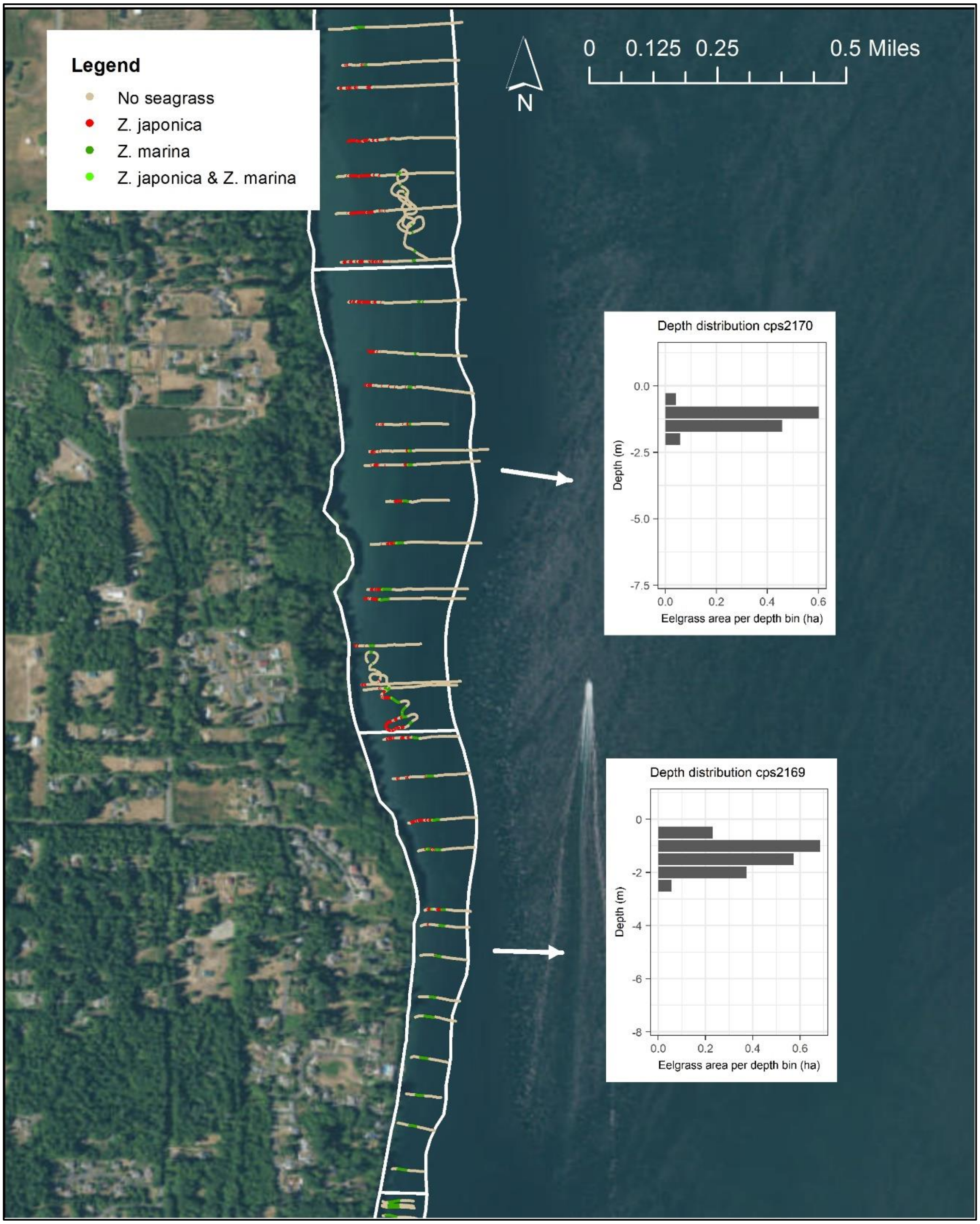

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.275
0.55
1.1 Miles
flats39: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps2176: no seagrass
cps2175: no seagrass

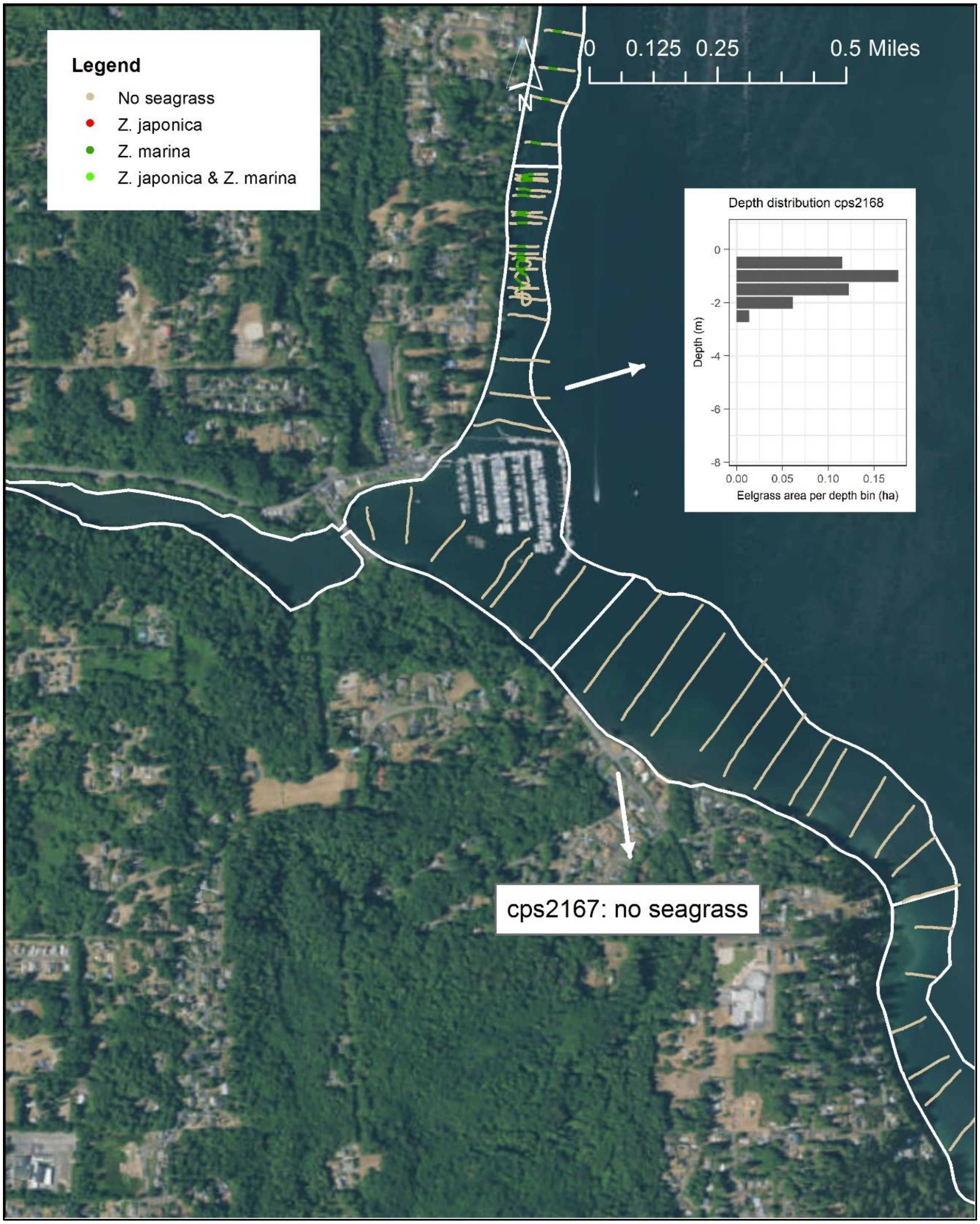


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
cps2174: no seagrass
cps2173: no seagrass

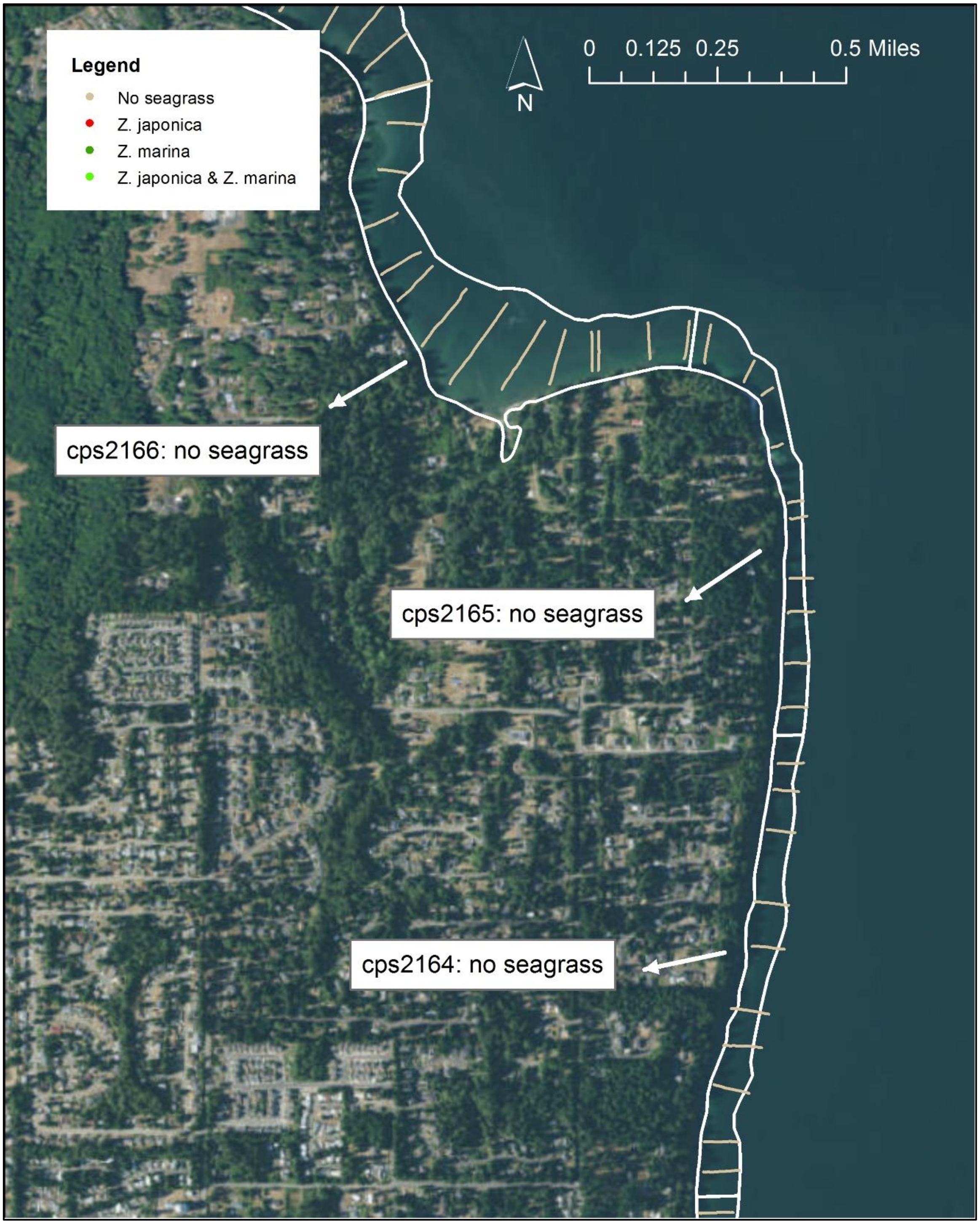

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2172: trace seagrass
Depth distribution cps2171
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.1 0.2 0.3 0.4
Eelgrass area per depth bin (ha)

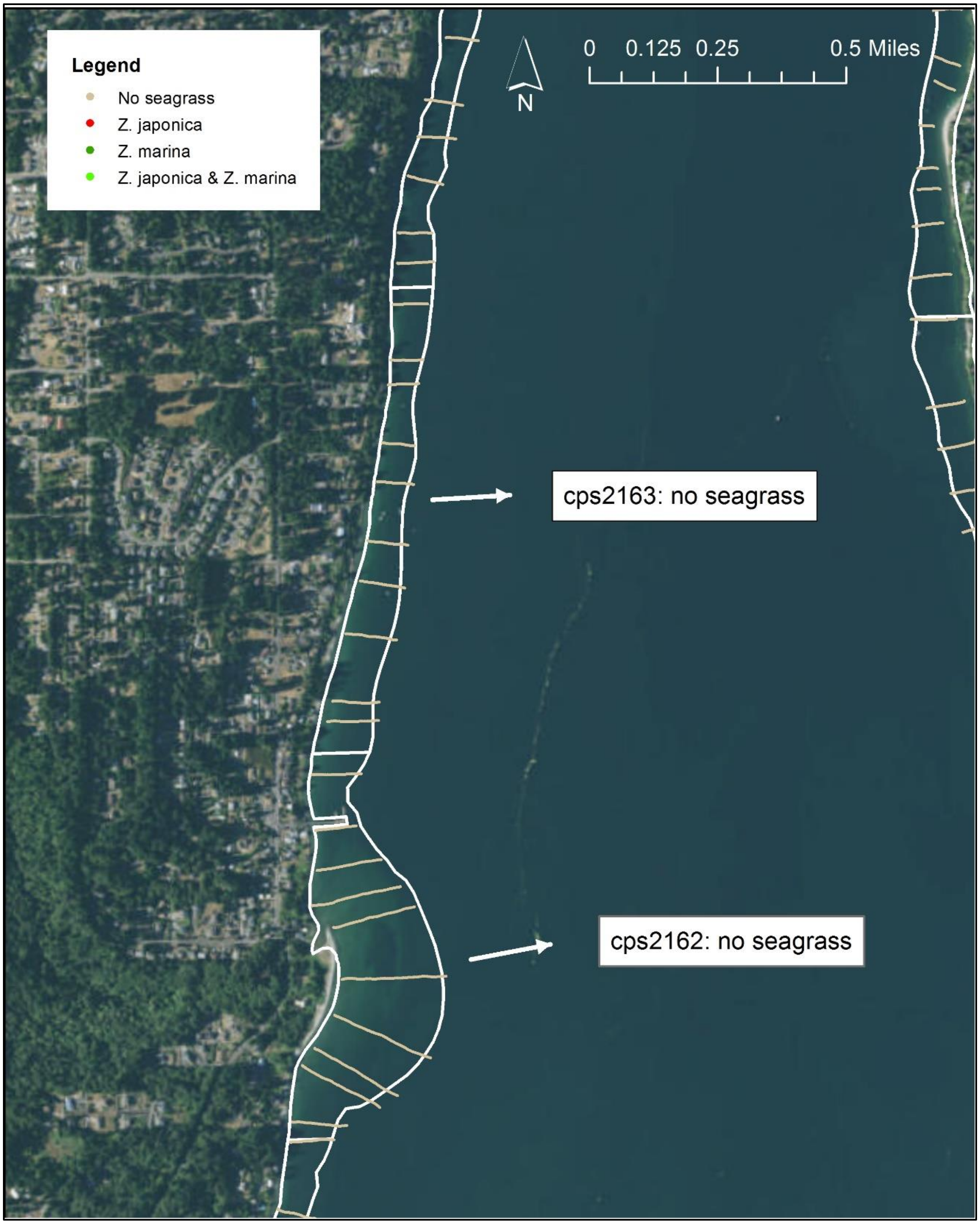


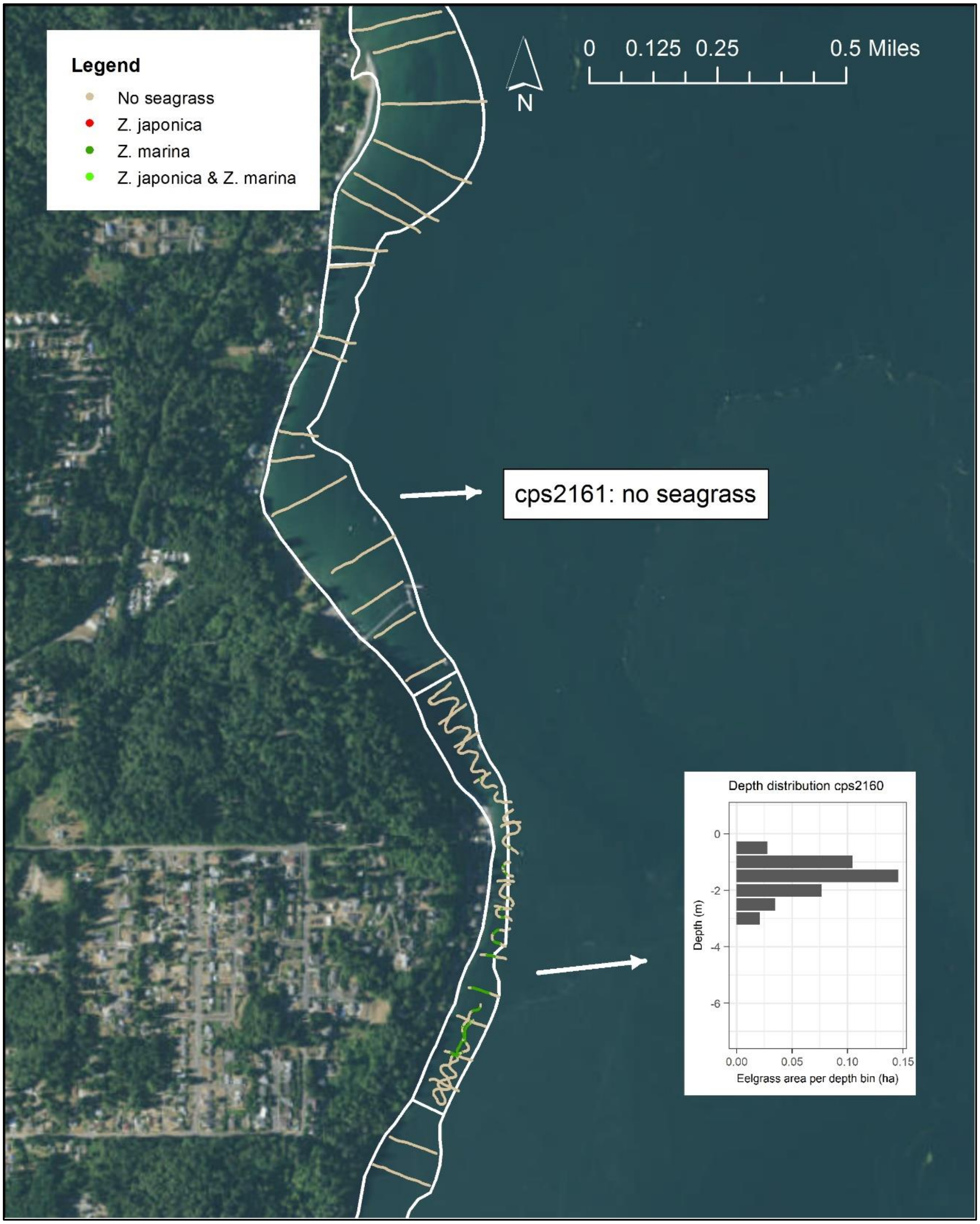
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2170
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)
Depth distribution cps2169
Depth (m)
0
-2
-4
-6
-8
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)



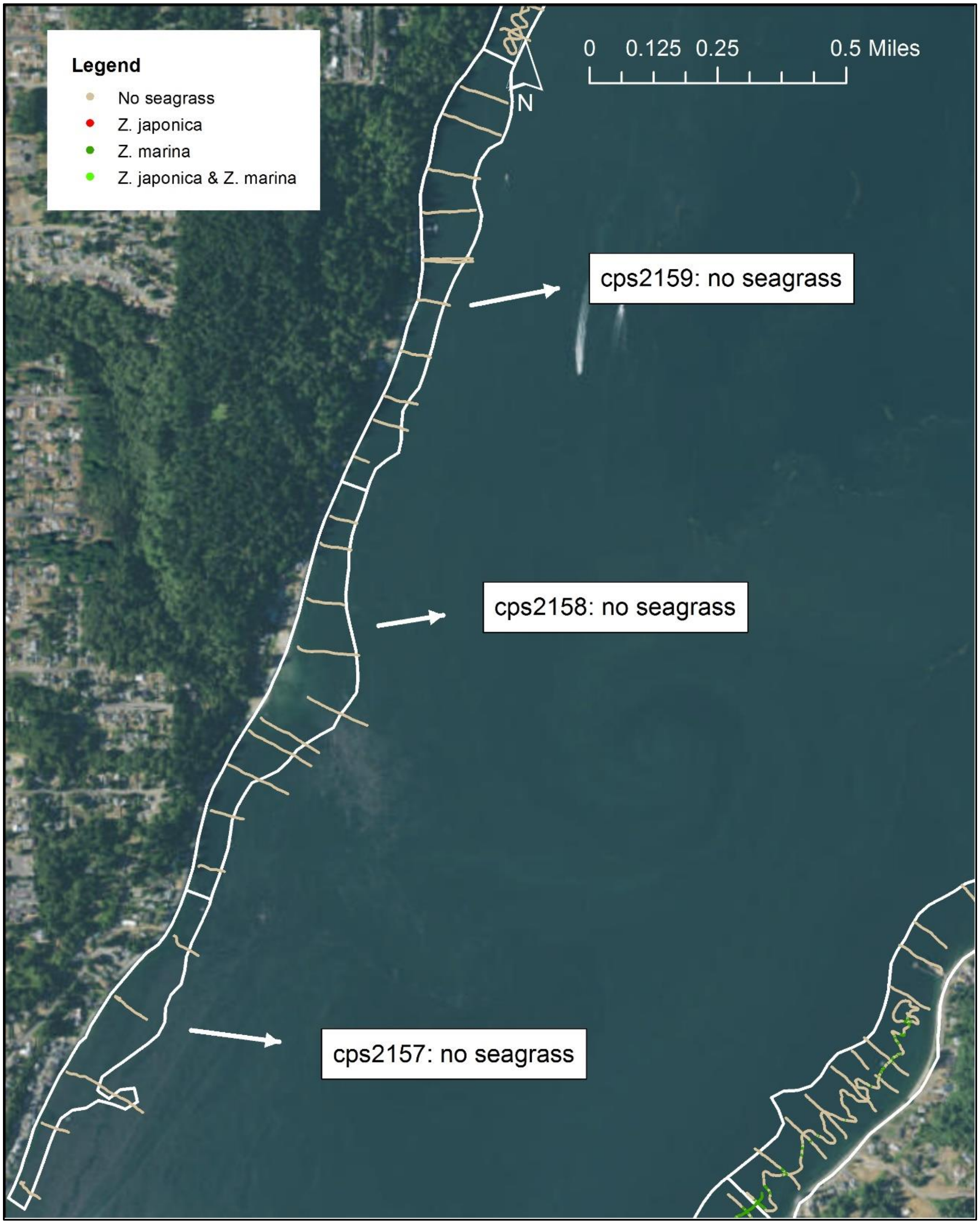
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
Depth distribution cps2168
Depth (m)
0
-2
-4
-6
-8
0.00 0.05 0.10 0.15
Eelgrass area per depth bin (ha)
cps2167: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0
0.125
0.25
0.5 Miles
N
cps2166: no seagrass
cps2165: no seagrass
cps2164: no seagrass

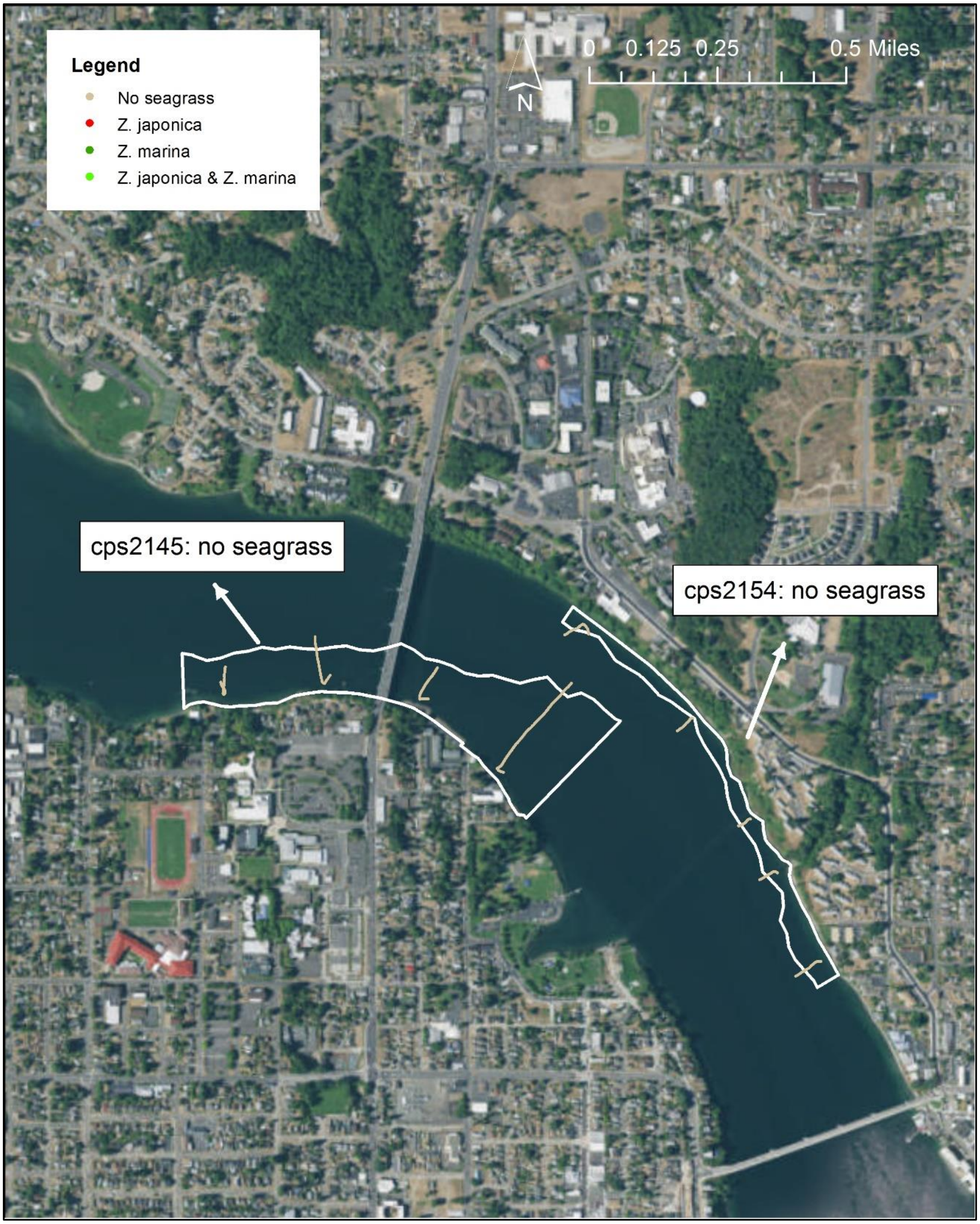

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2163: no seagrass
cps2162: no seagrass



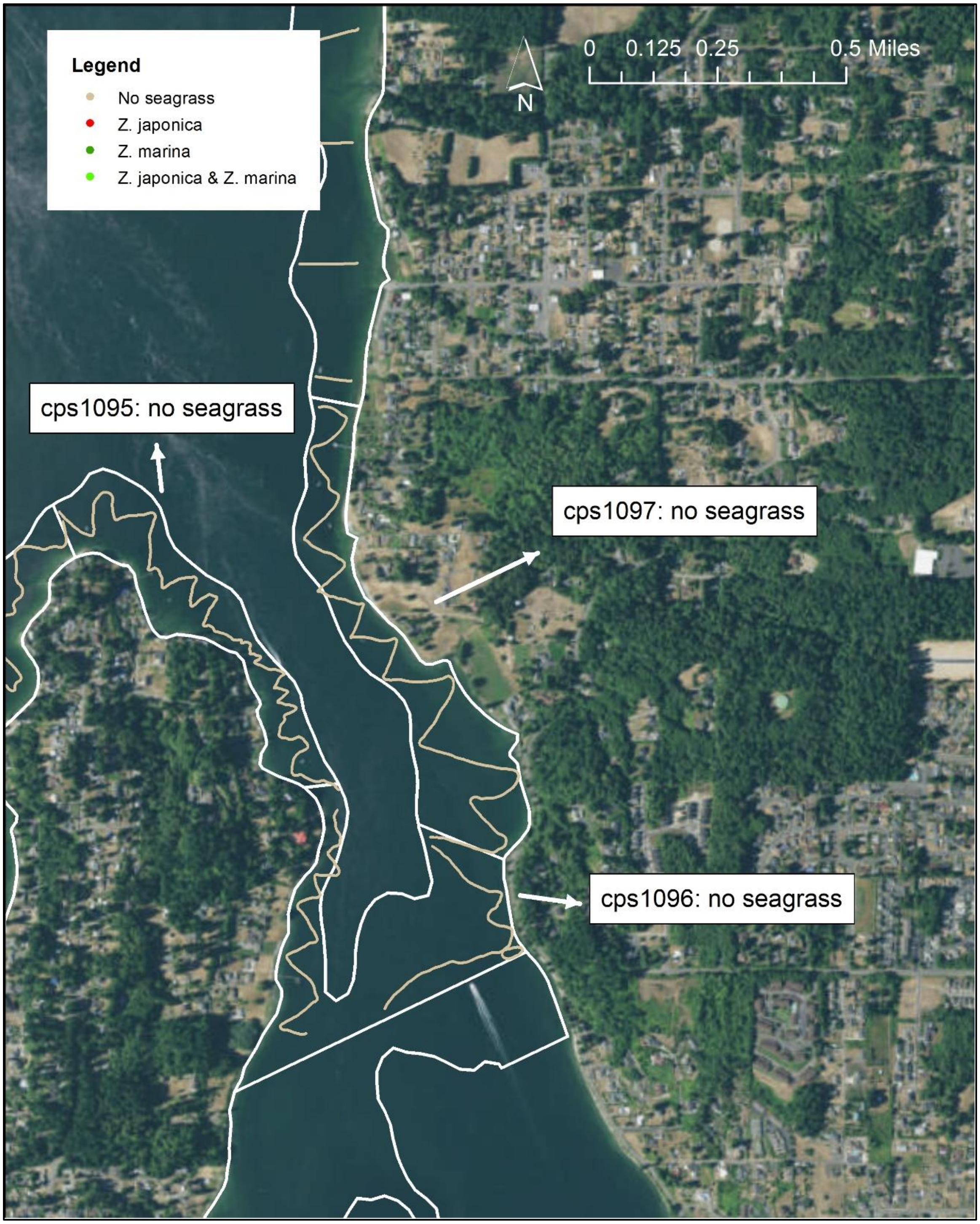
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps2161: no seagrass
Depth distribution cps2160
Depth (m)
Eelgrass area per depth bin (ha)
0
-2
-4
-6
0.00 0.05 0.10 0.15

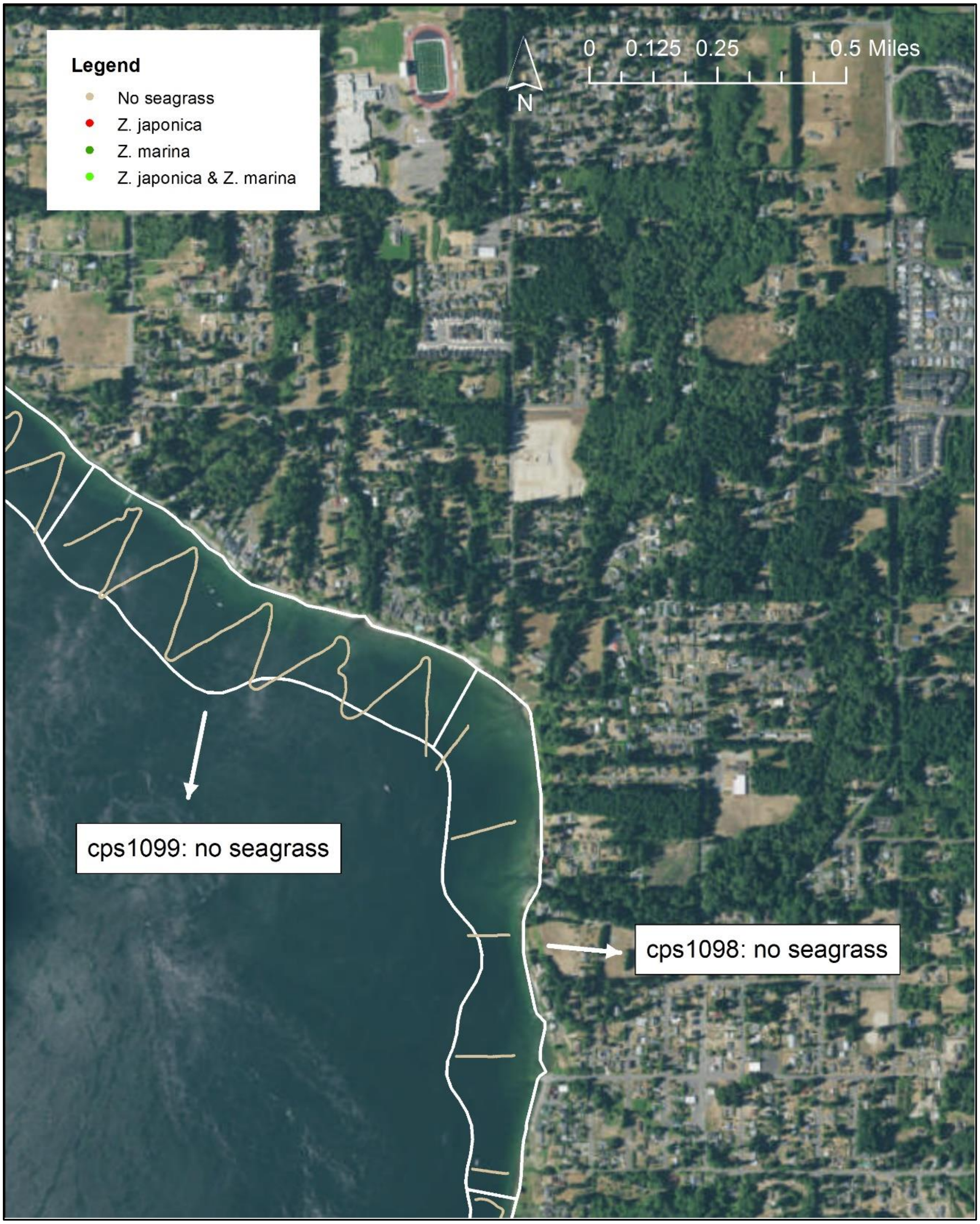


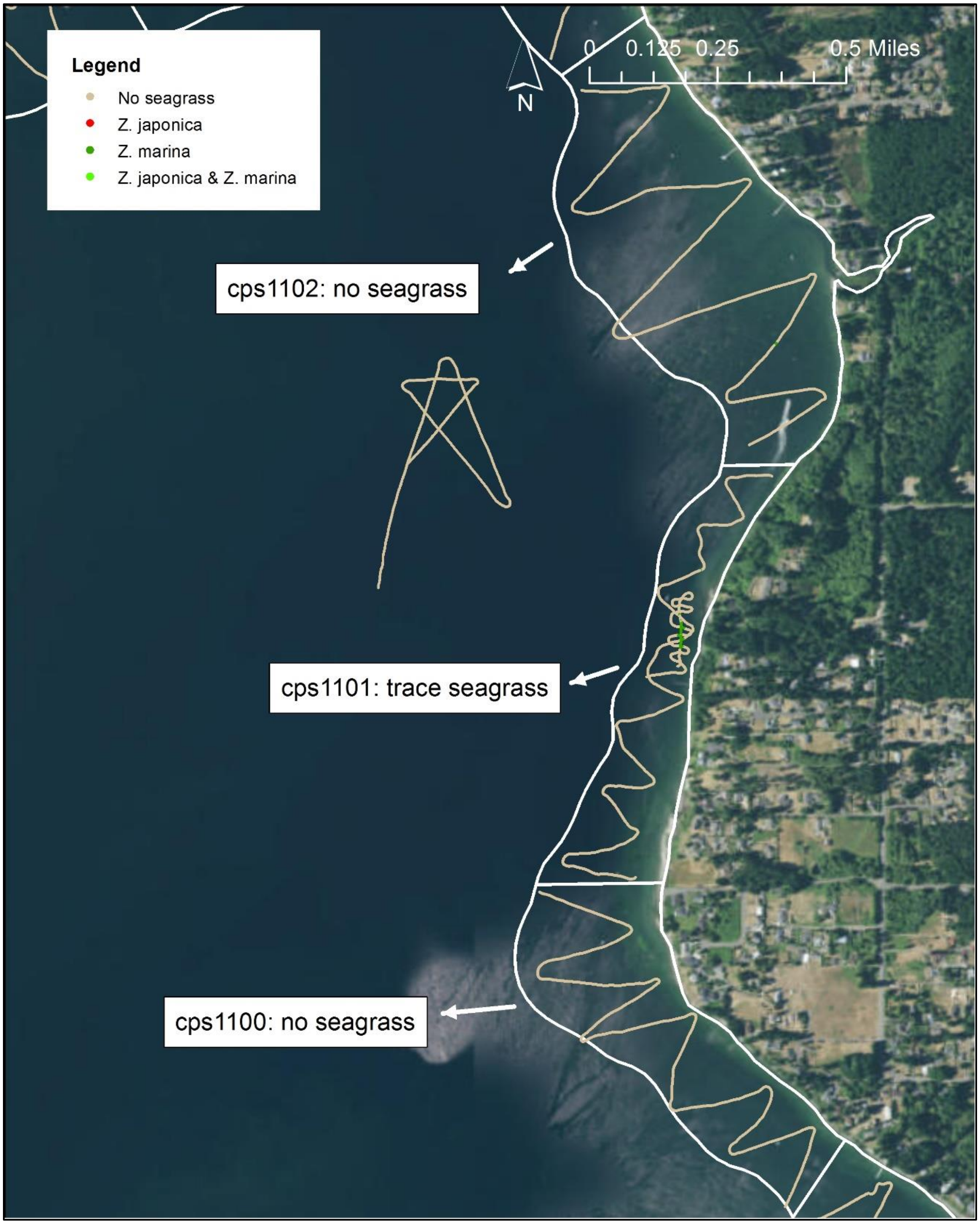
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps2159: no seagrass
cps2158: no seagrass
cps2157: no seagrass

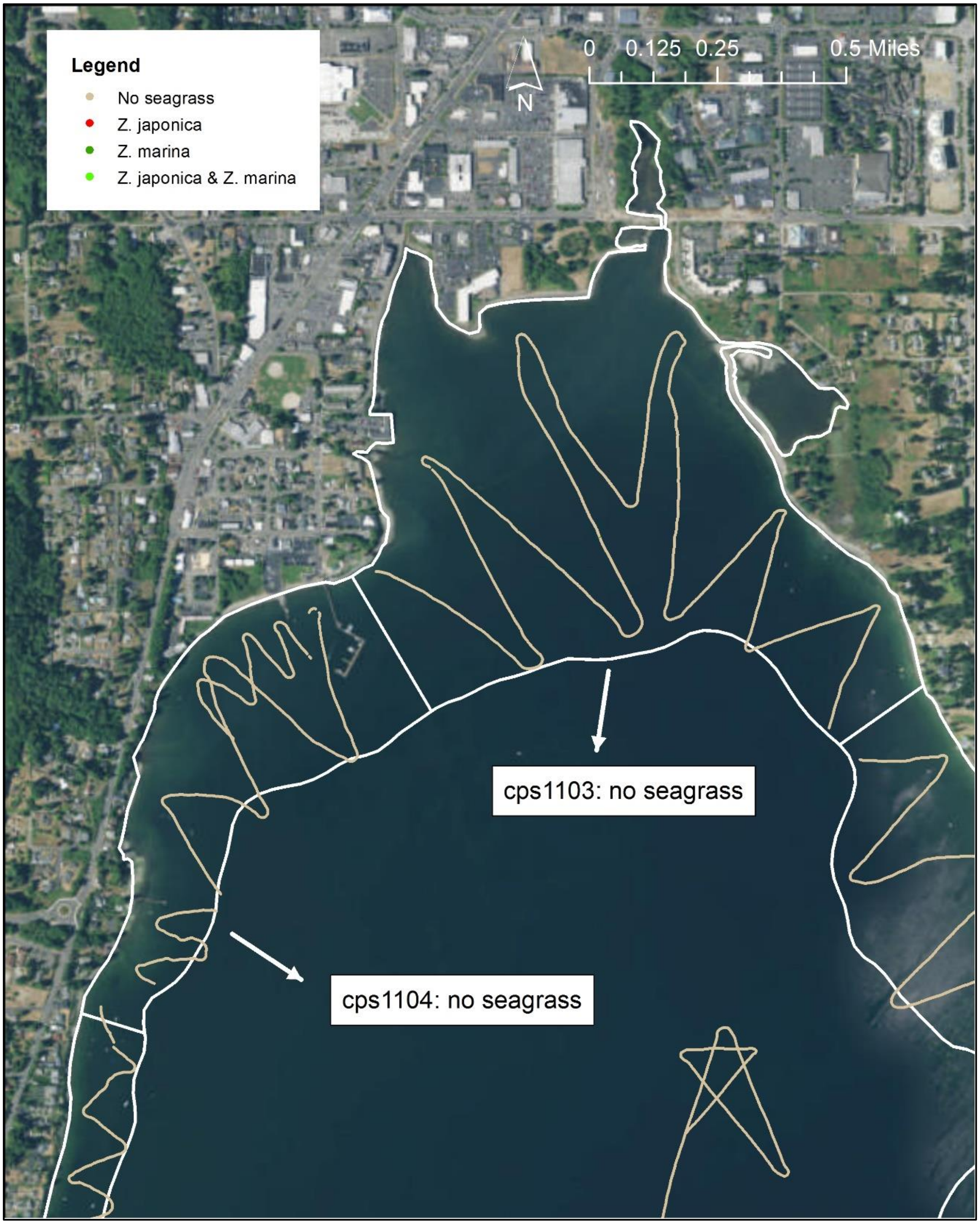


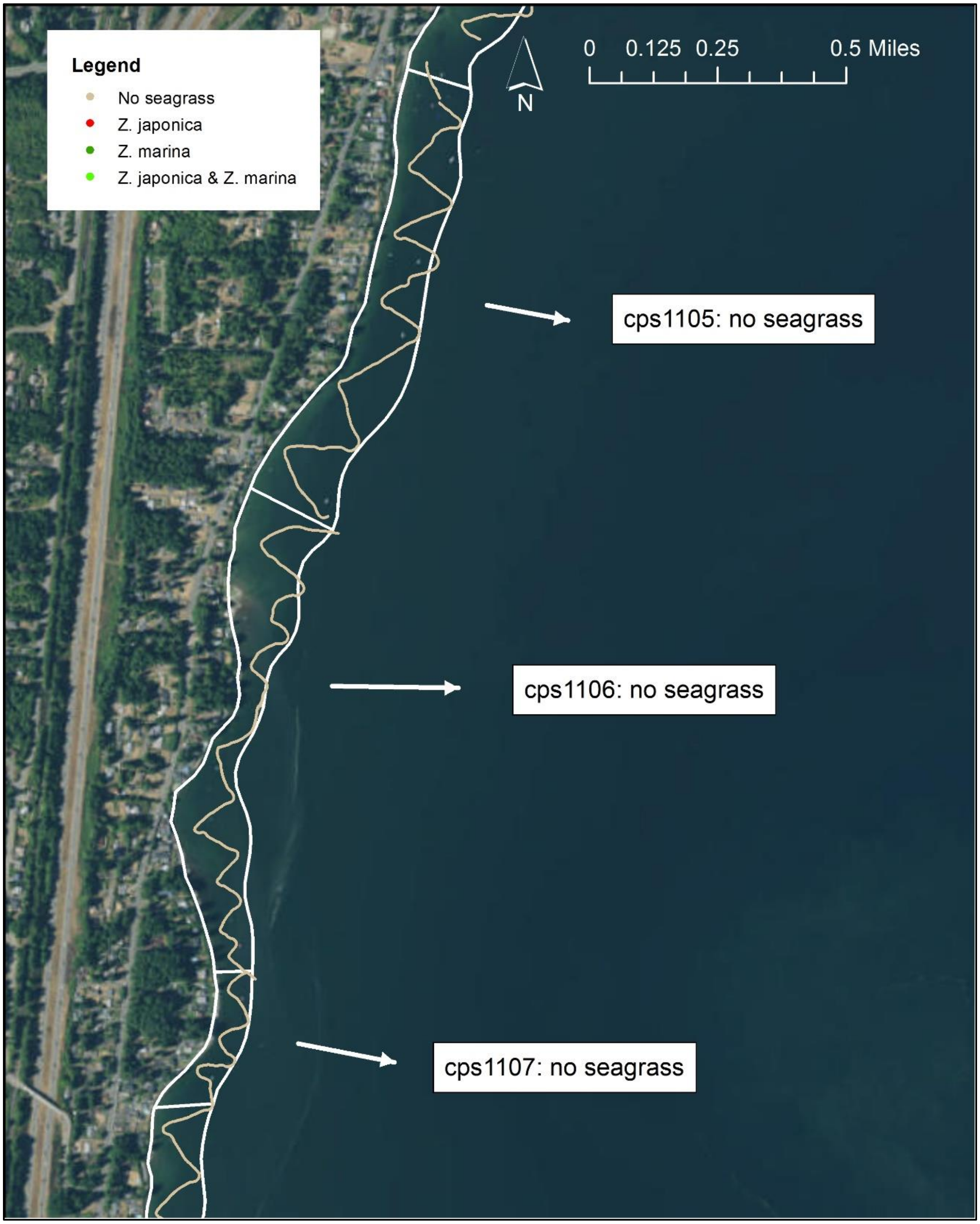
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
cps2145: no seagrass
cps2154: no seagrass

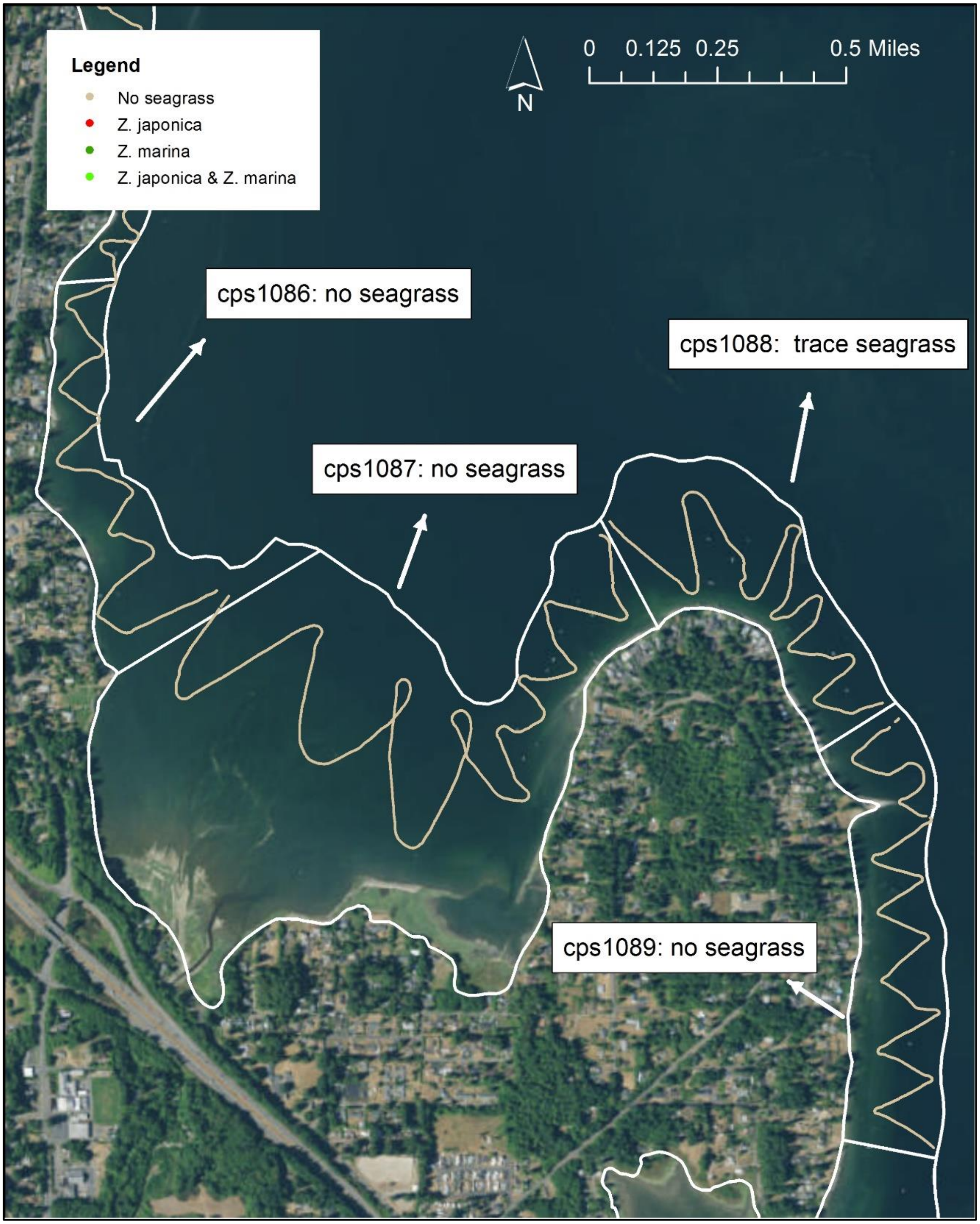

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps1095: no seagrass
cps1097: no seagrass
cps1096: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1099: no seagrass
cps1098: no seagrass

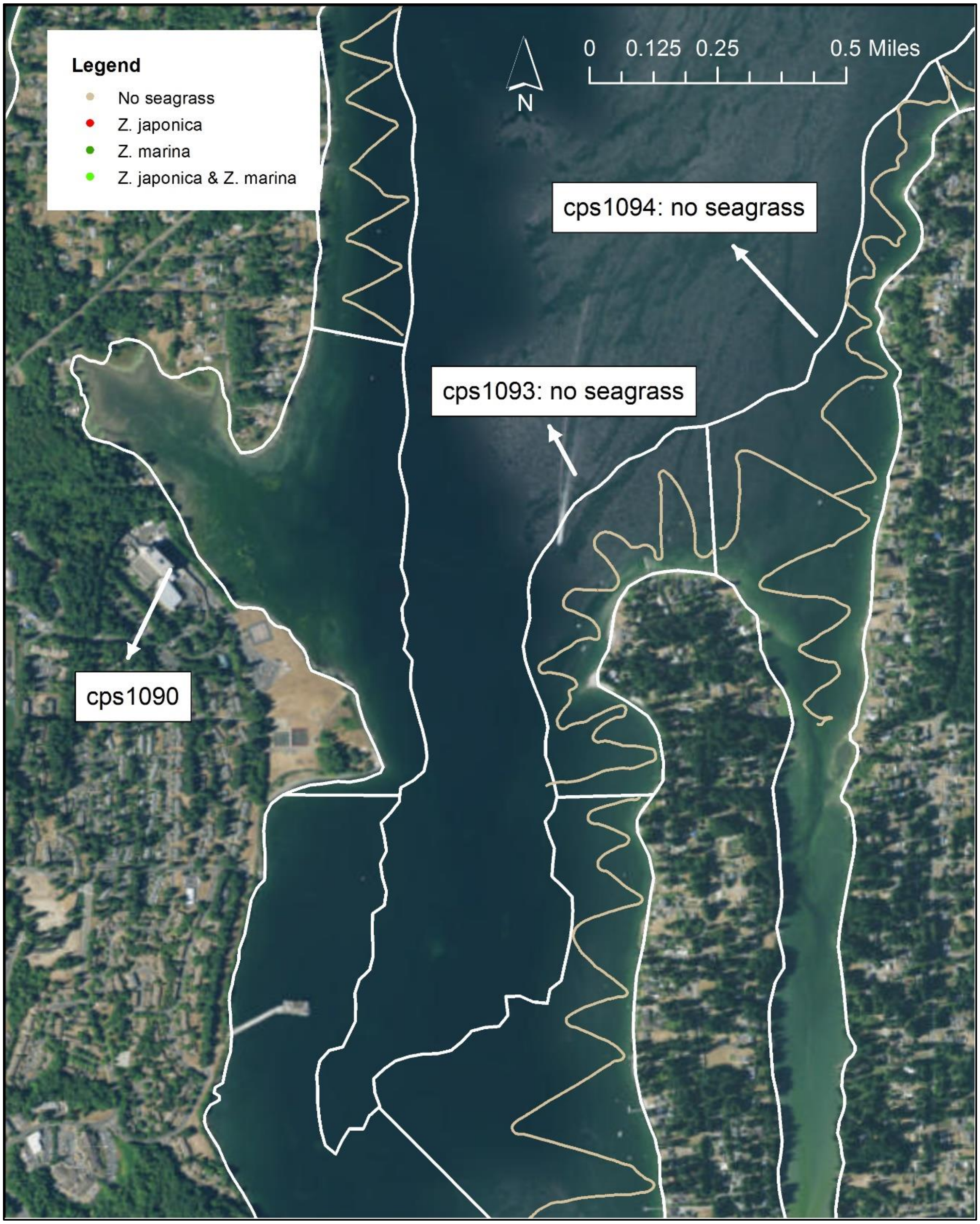

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps1102: no seagrass
cps1101: trace seagrass
cps1100: no seagrass

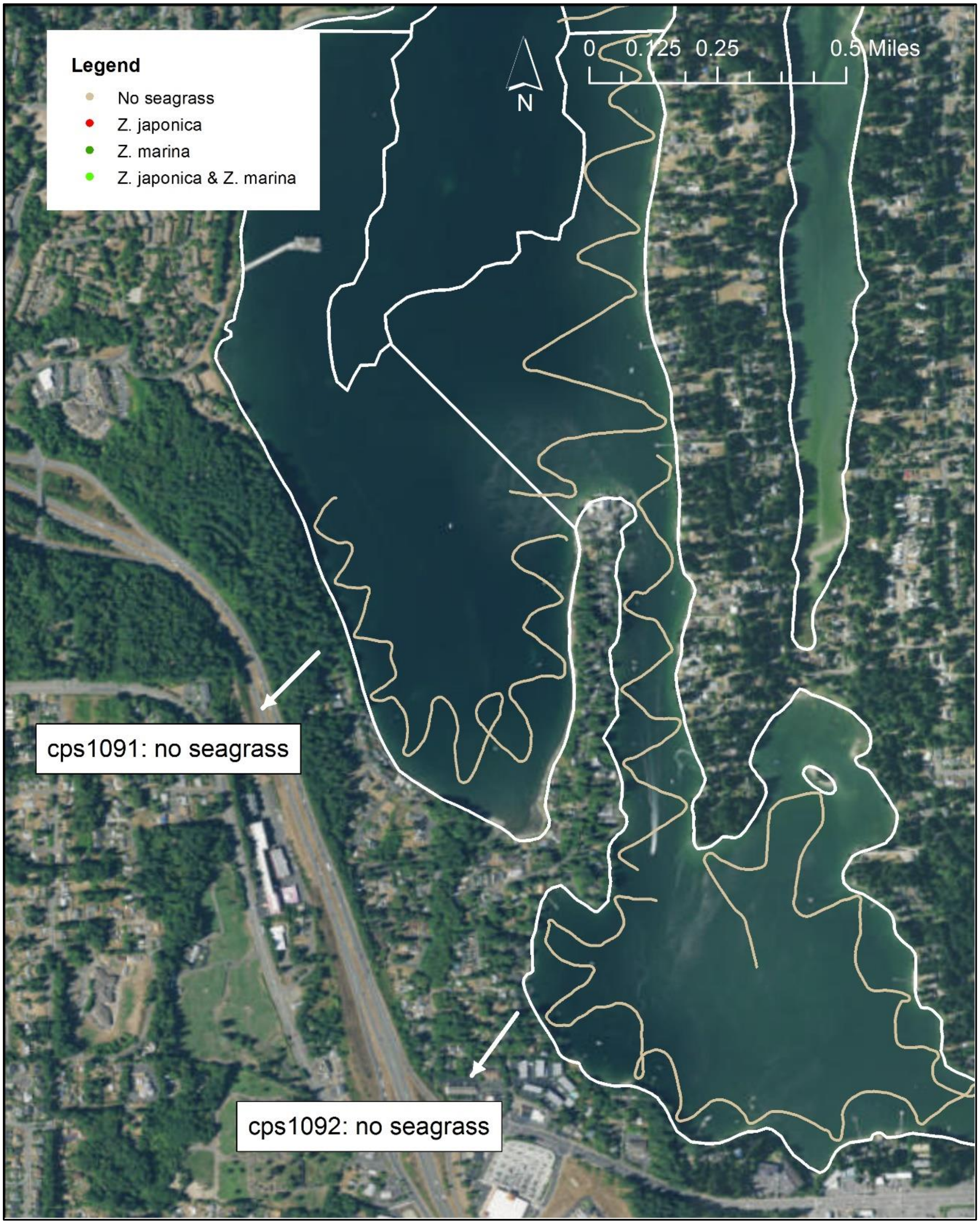

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1103: no seagrass
cps1104: no seagrass

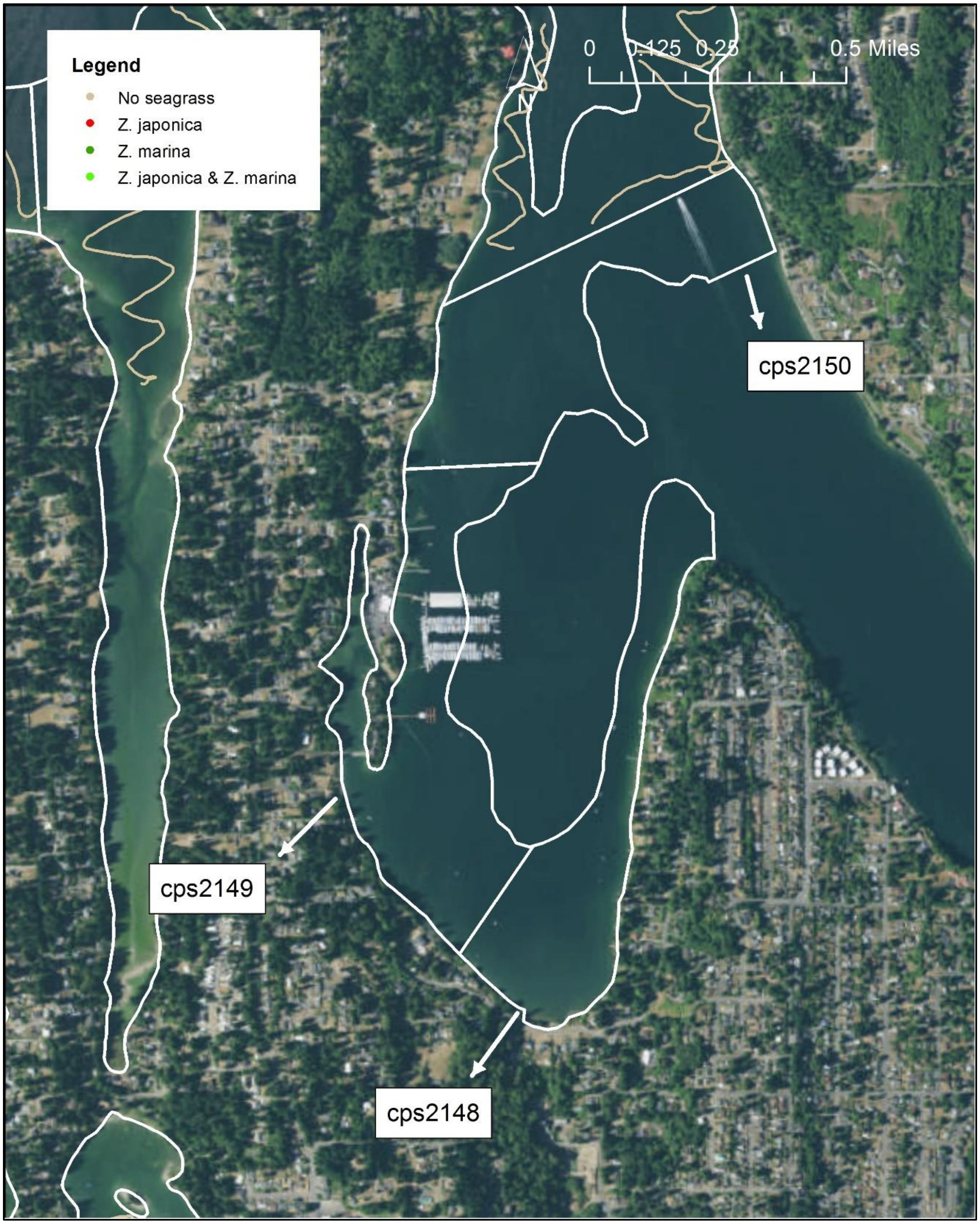

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1105: no seagrass
cps1106: no seagrass
cps1107: no seagrass

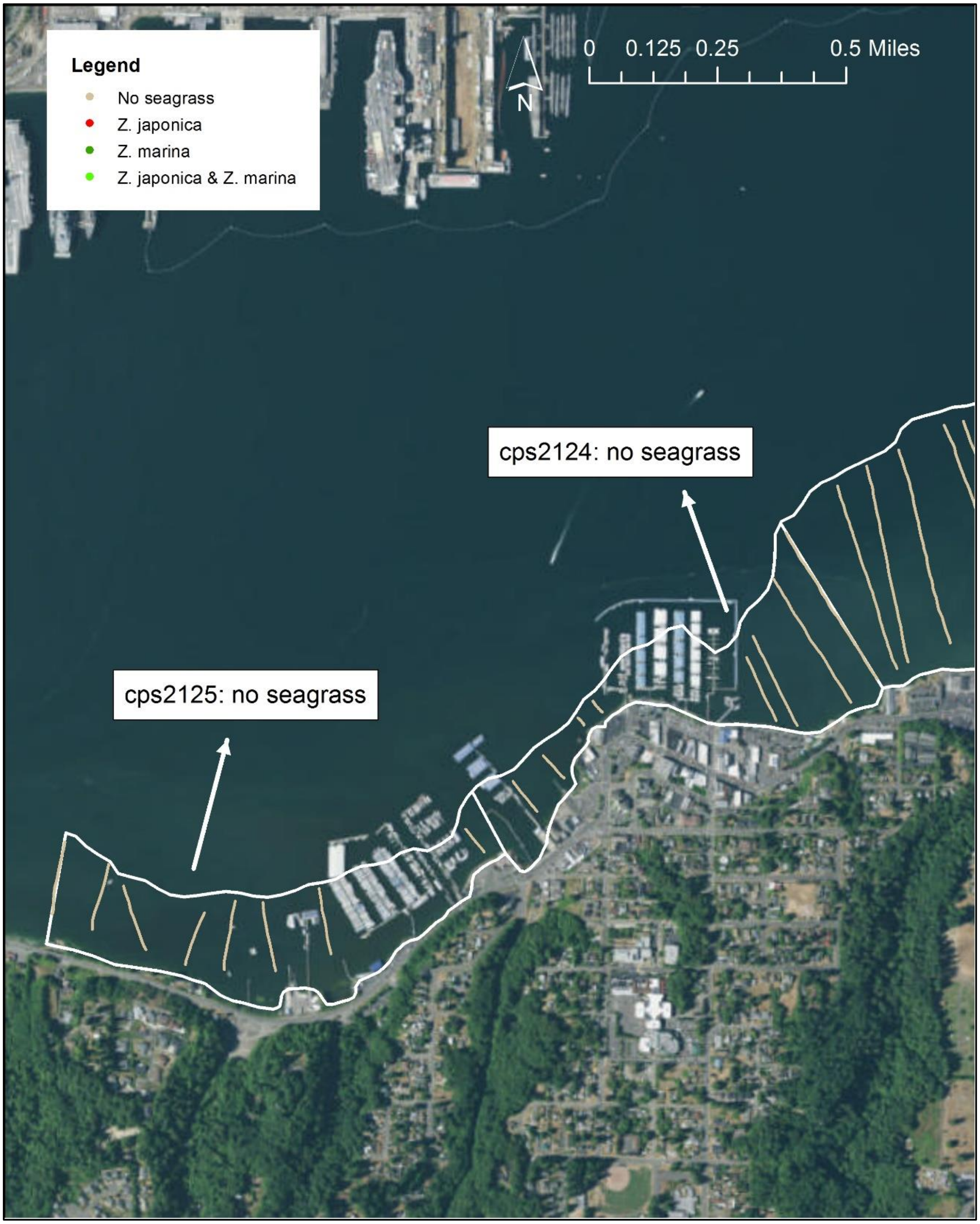


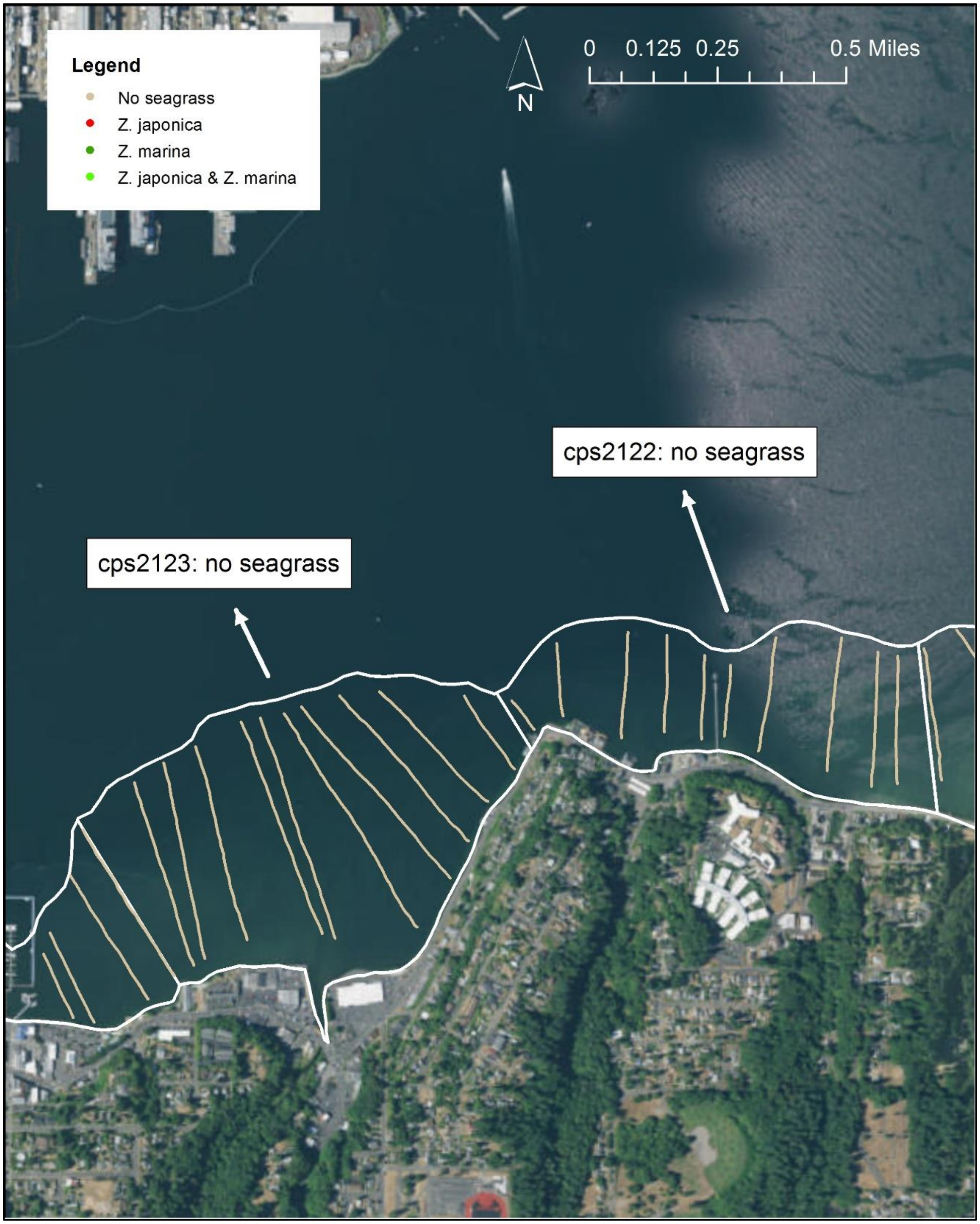
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1086: no seagrass
cps1088: trace seagrass
cps1087: no seagrass
cps1089: no seagrass

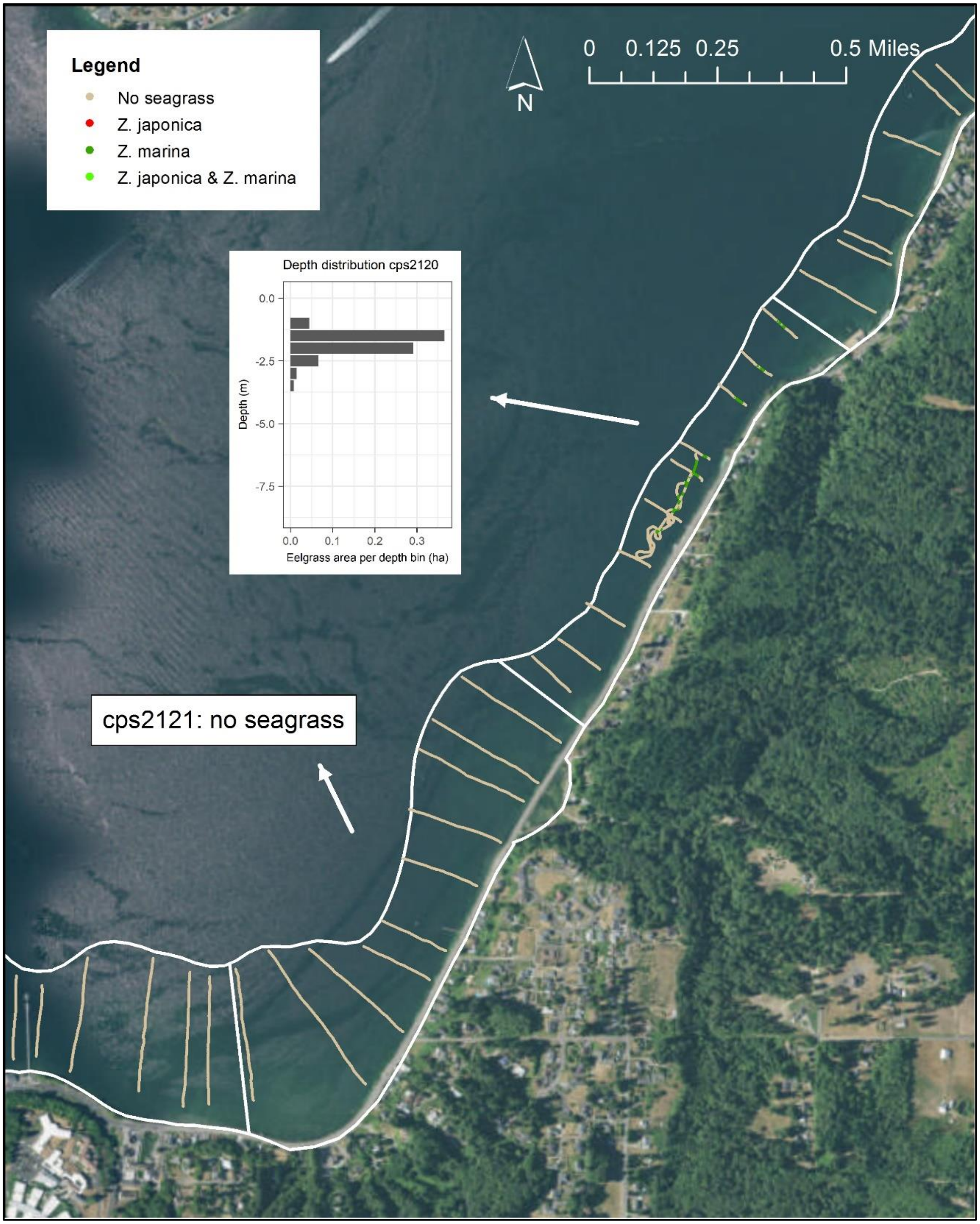

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps1094: no seagrass
cps1093: no seagrass
cps1090

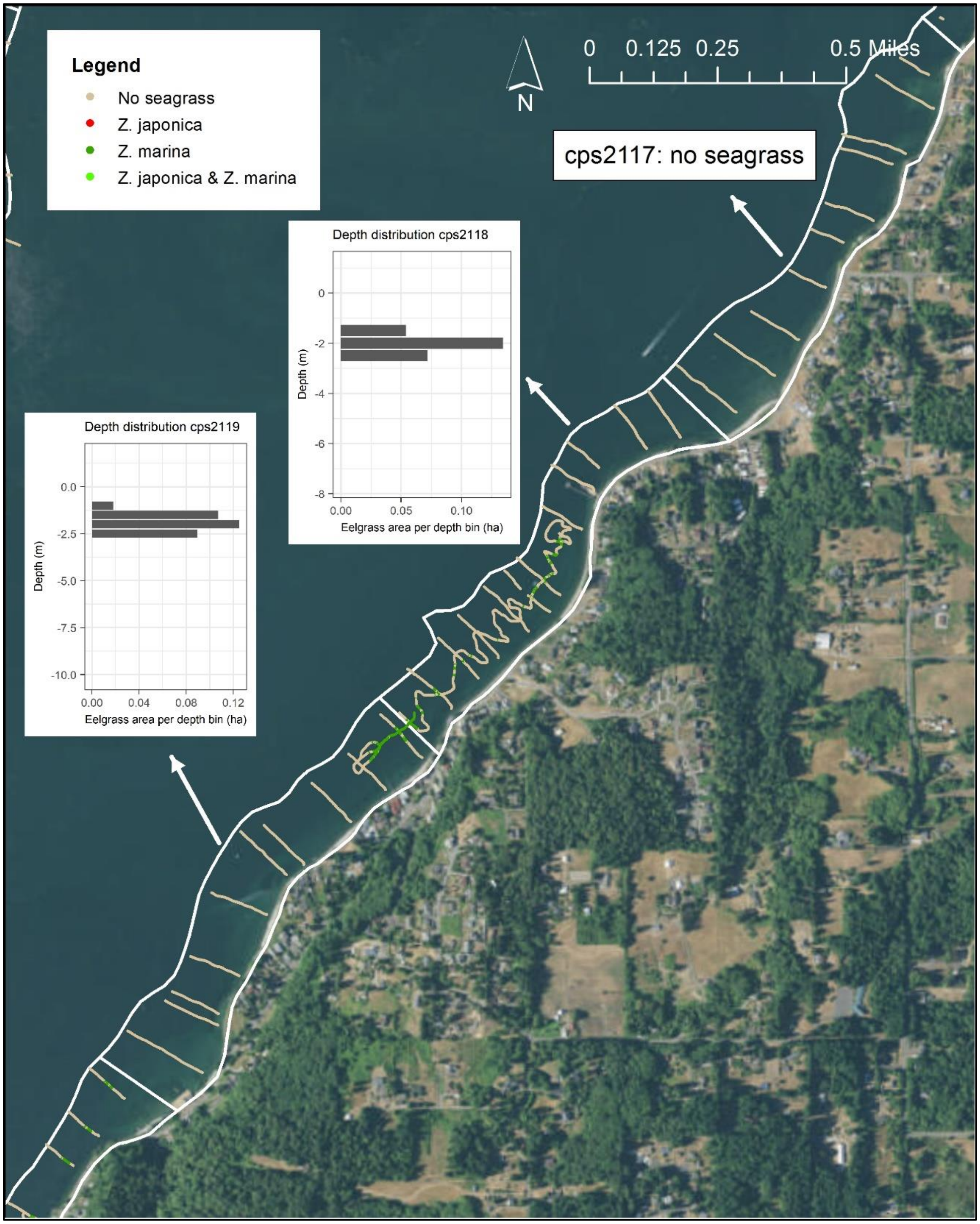

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1091: no seagrass
cps1092: no seagrass

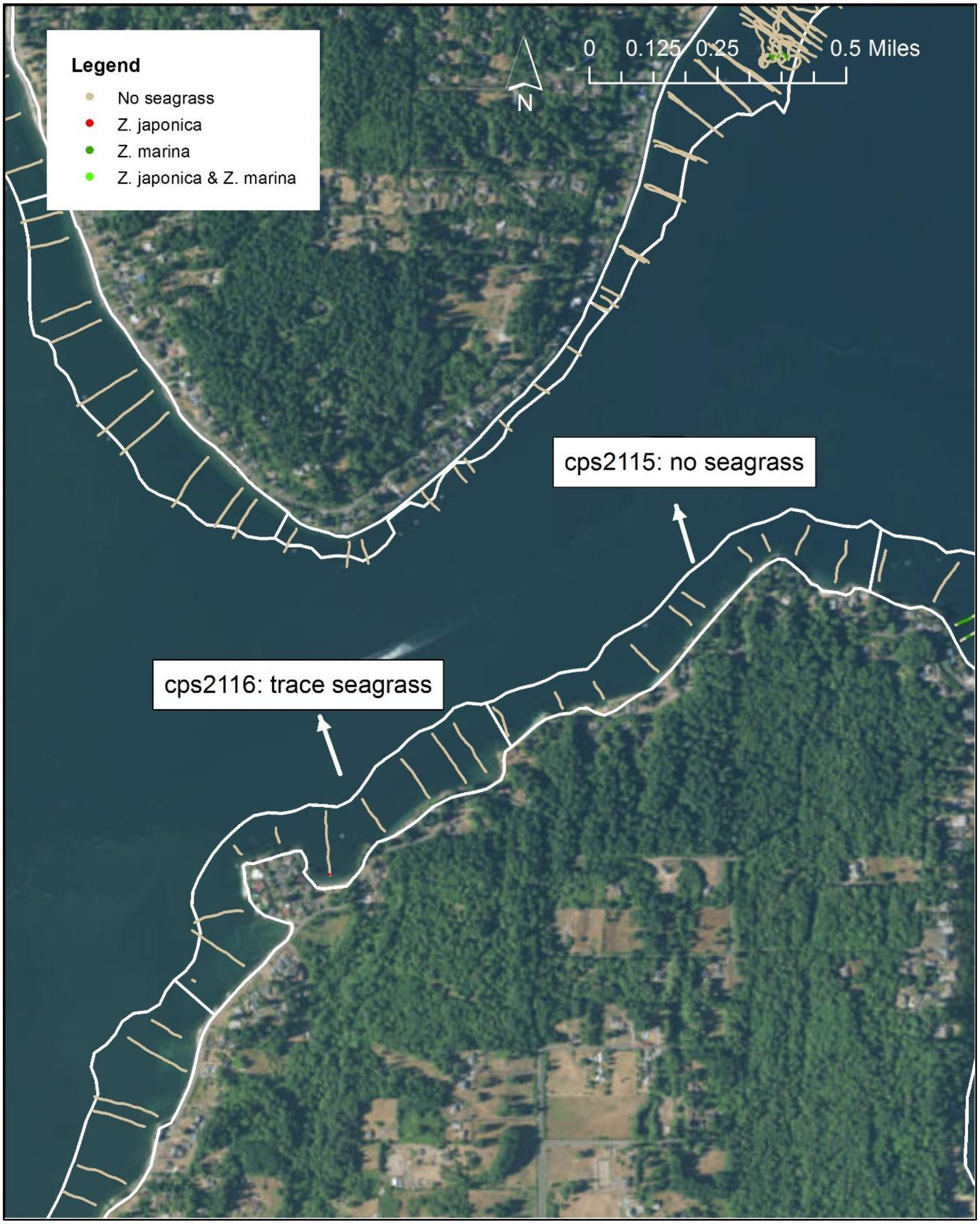

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps2150
cps2149
cps2148


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0
0.125
0.25
0.5 Miles
N
cps2124: no seagrass
cps2125: no seagrass

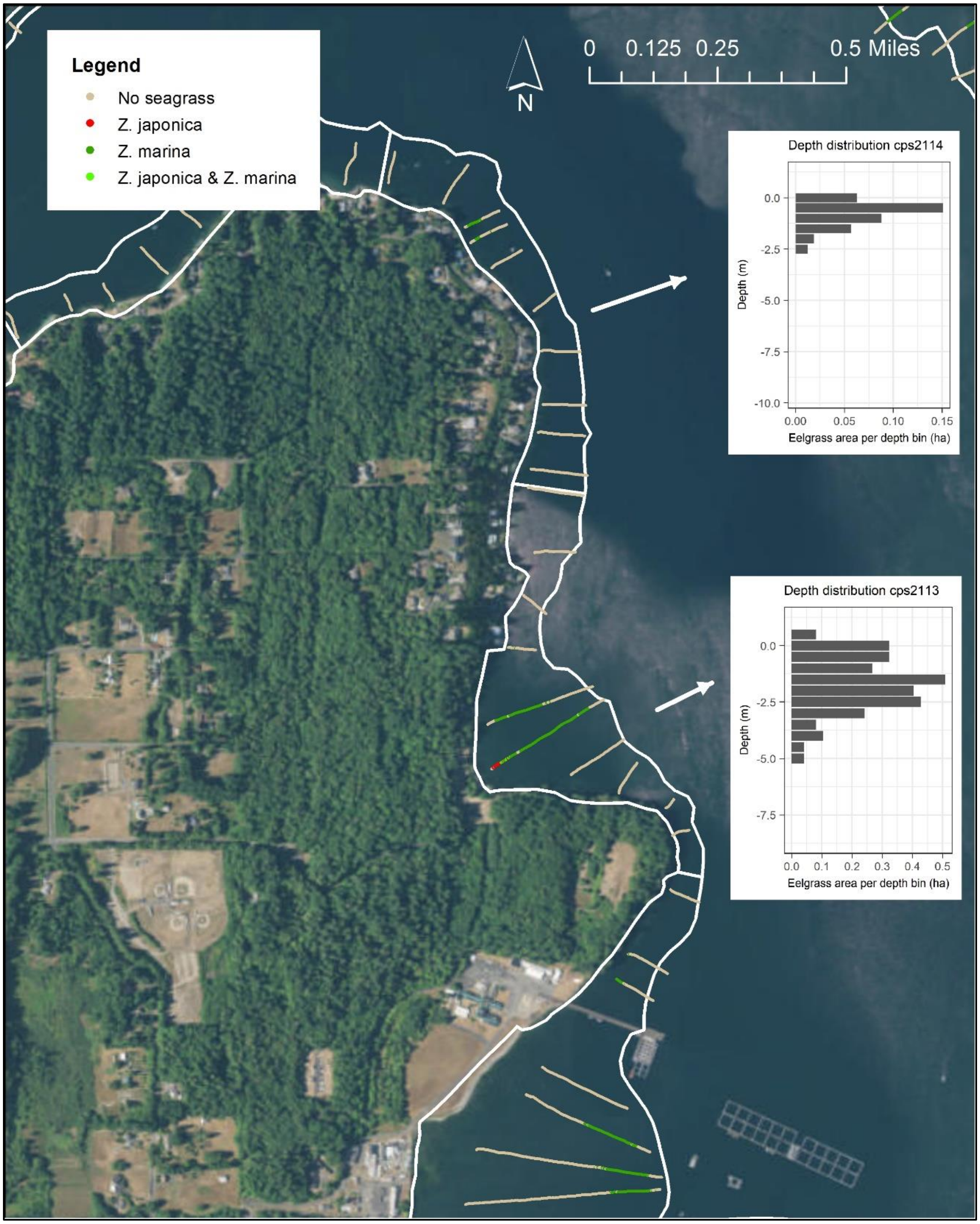

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2122: no seagrass
cps2123: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2120
0.0
-2.5
-5.0
-7.5
Depth (m)
0.0 0.1 0.2 0.3
Eelgrass area per depth bin (ha)
cps2121: no seagrass

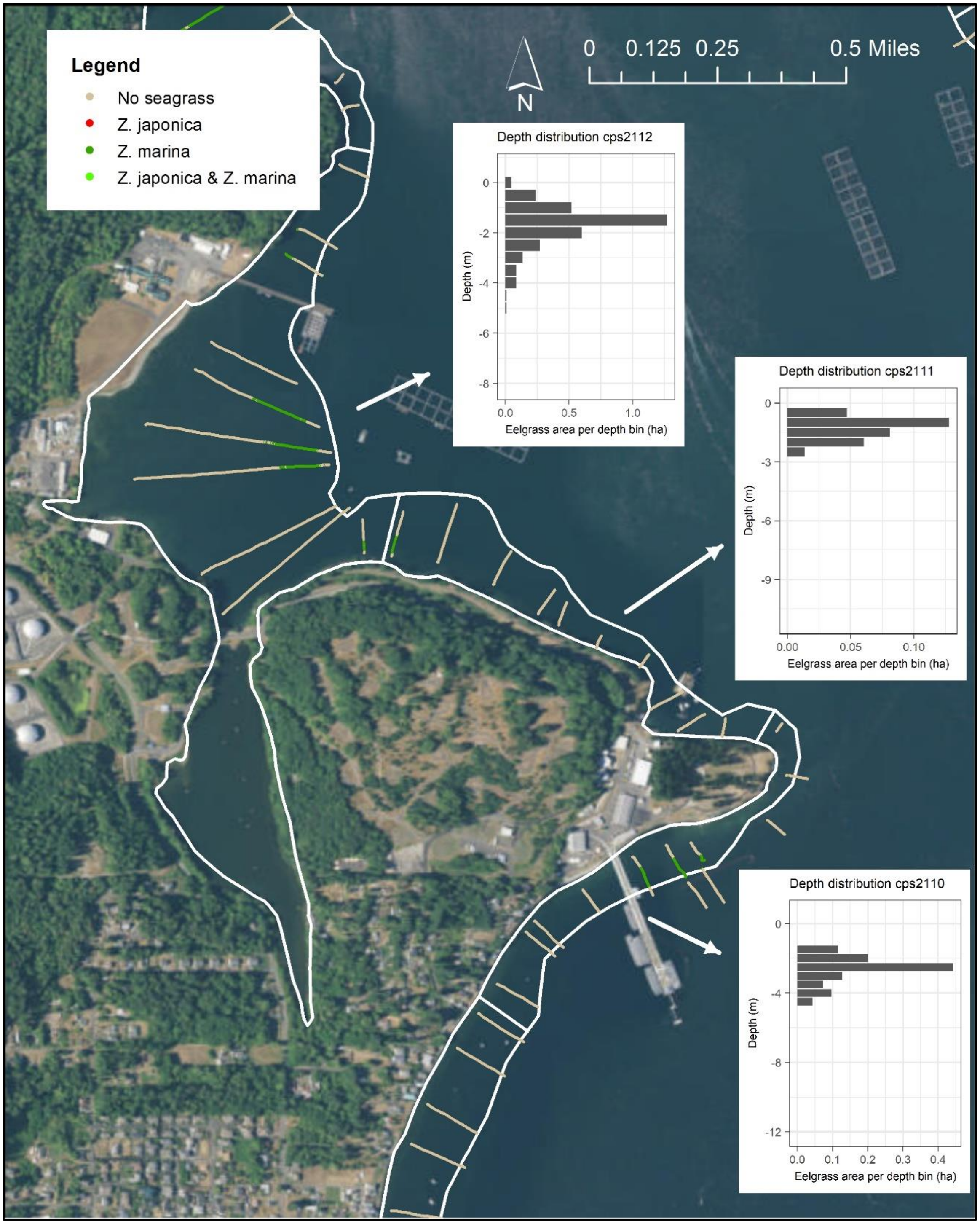

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2117: no seagrass
Depth distribution cps2118
Depth (m)
0
-2
-4
-6
-8
0.00 0.05 0.10
Eelgrass area per depth bin (ha)
Depth distribution cps2119
Depth (m)
0.0
-2.5
-5.0
-7.5
-10.0
0.00 0.04 0.08 0.12
Eelgrass area per depth bin (ha)



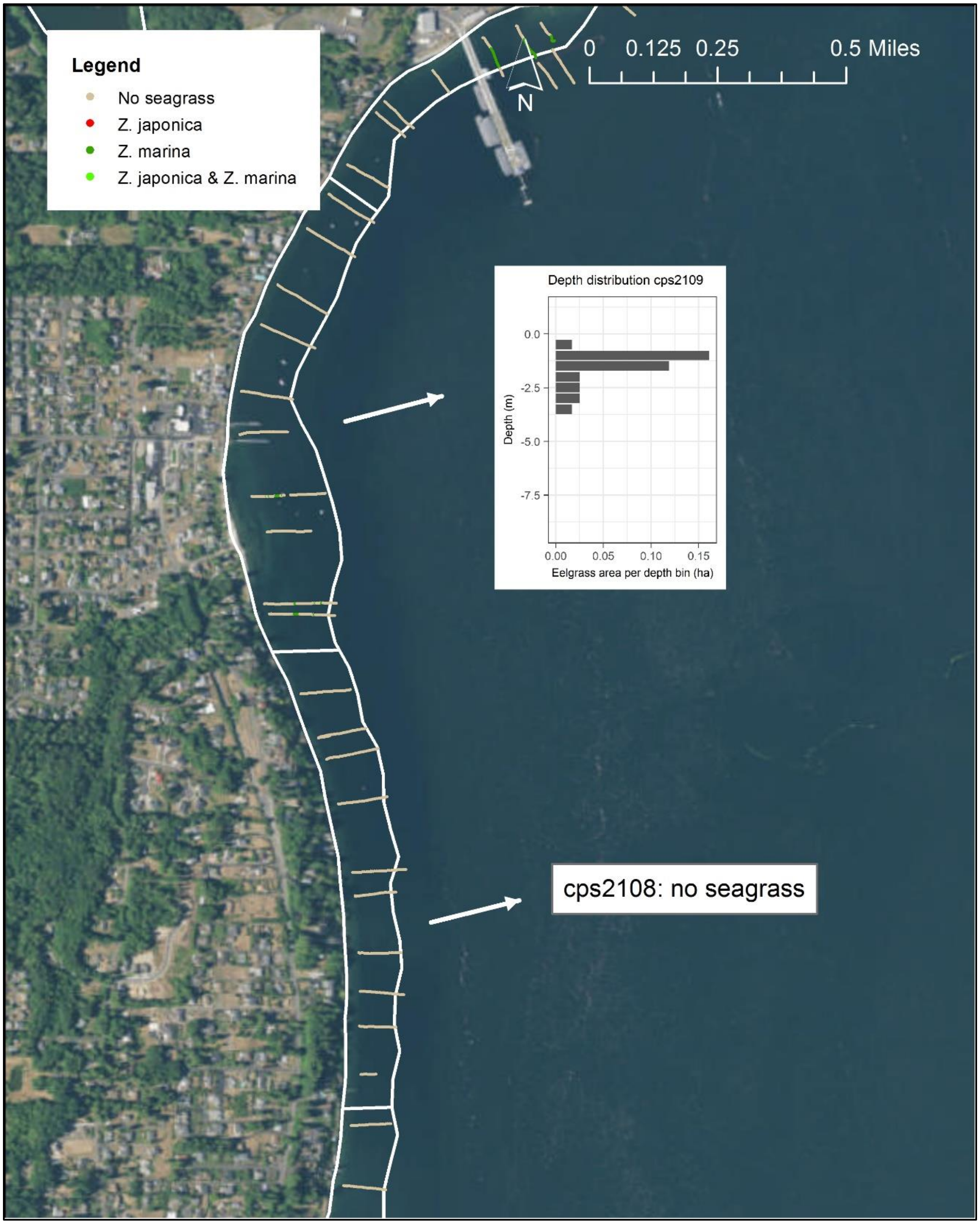
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
cps2115: no seagrass
cps2116: trace seagrass



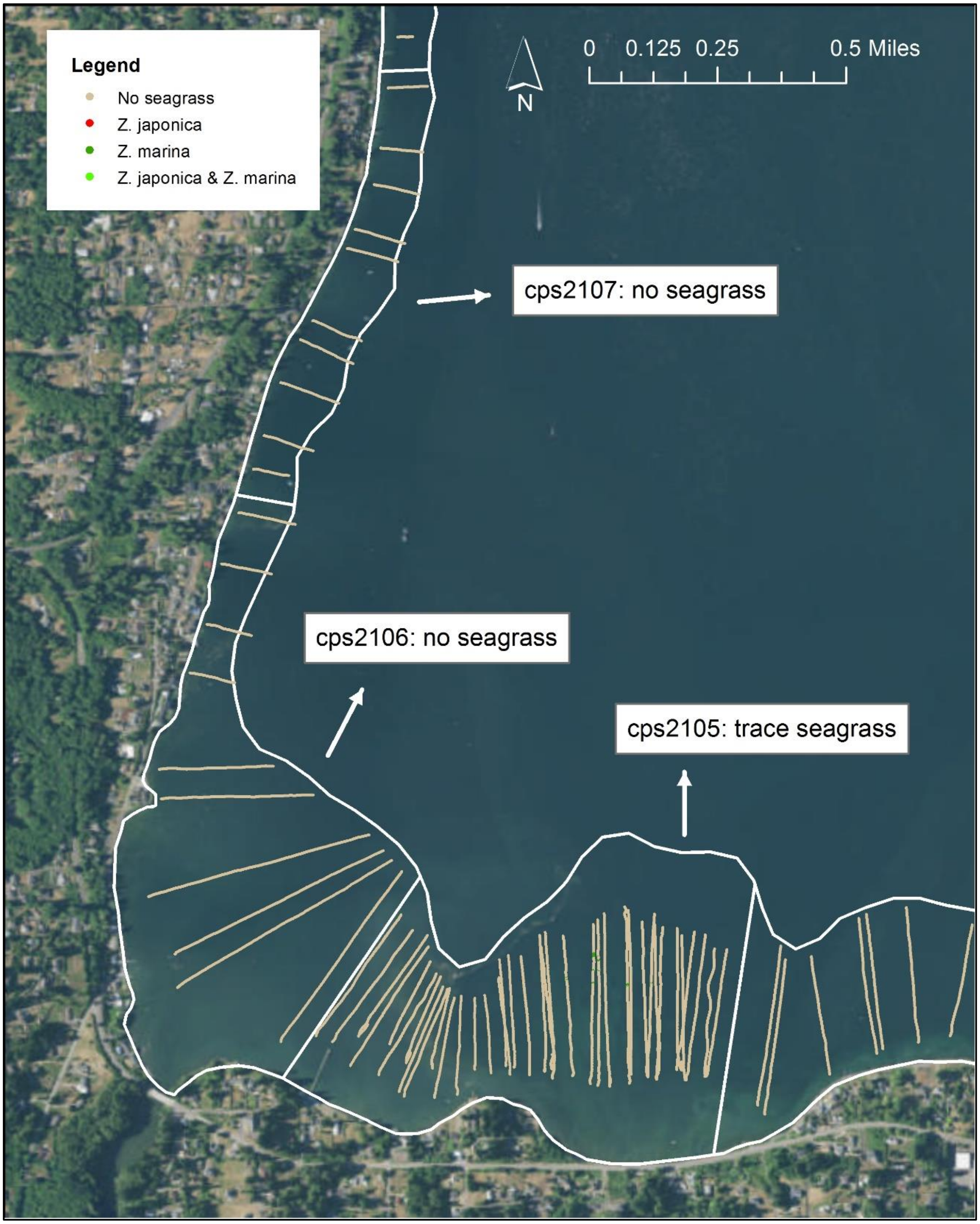
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2114
Depth (m)
0.0
-2.5
-5.0
-7.5
-10.0
0.00 0.05 0.10 0.15
Eelgrass area per depth bin (ha)
Depth distribution cps2113
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.1 0.2 0.3 0.4 0.5
Eelgrass area per depth bin (ha)

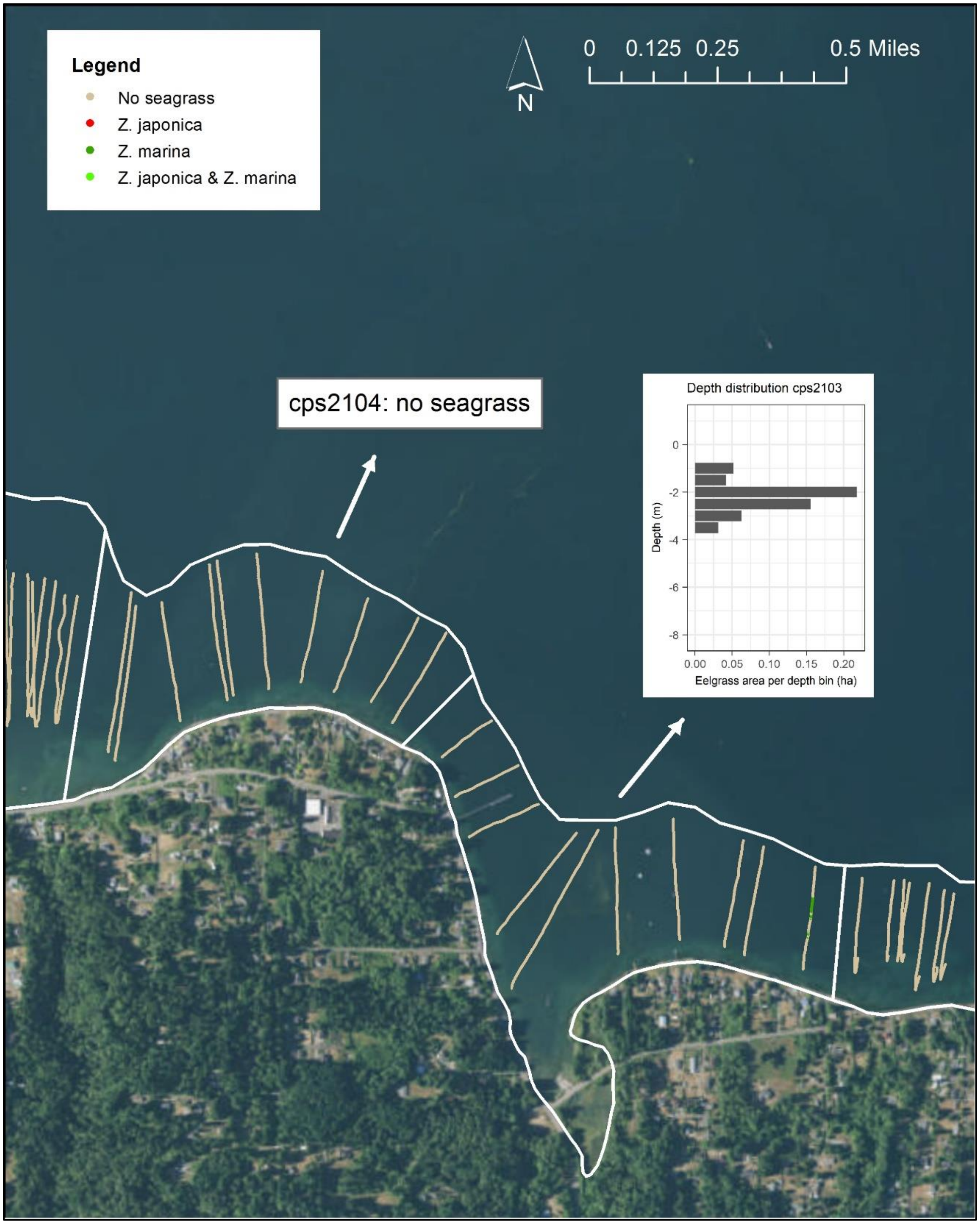


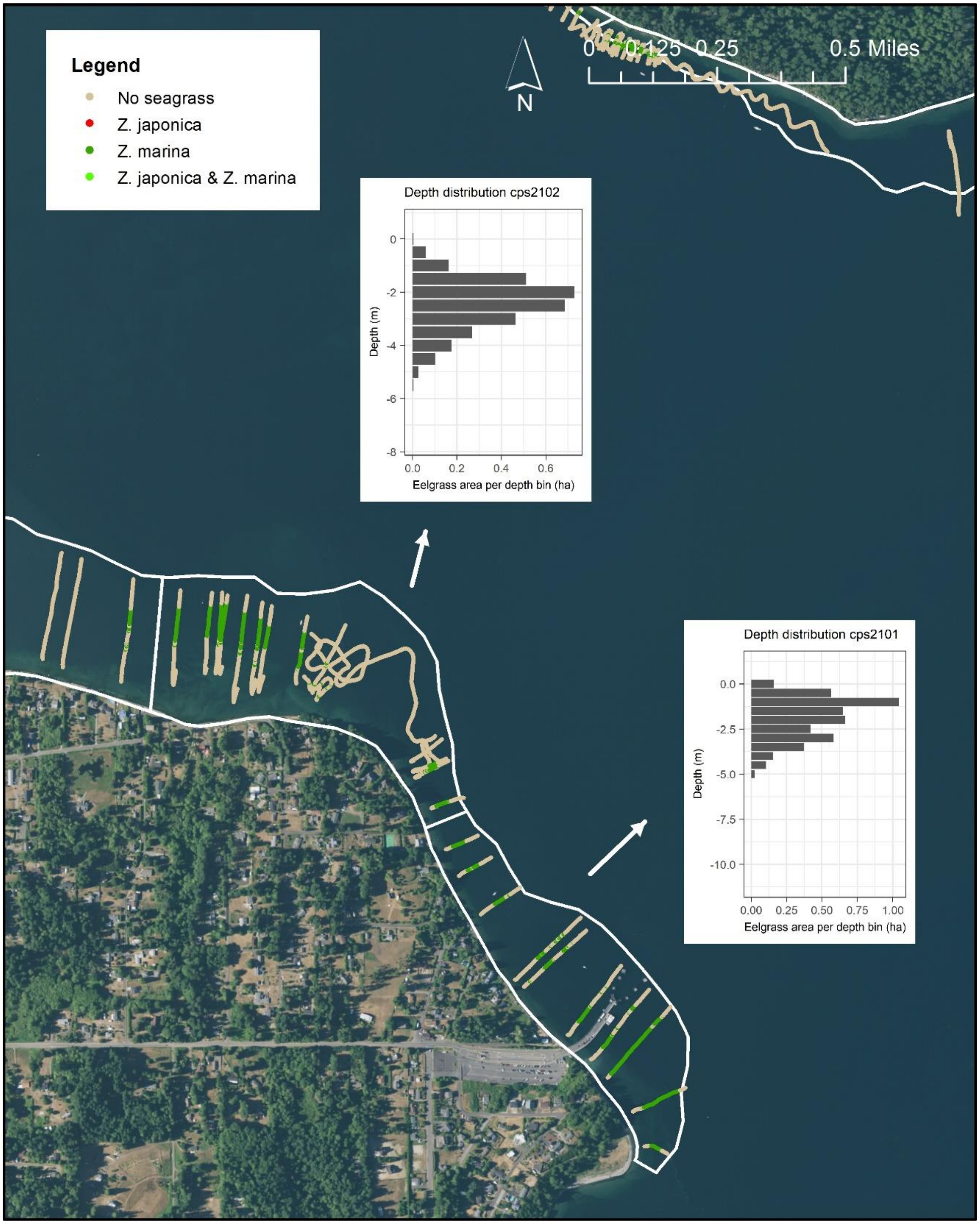
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2112
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2111
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps2110
Depth (m)
Eelgrass area per depth bin (ha)



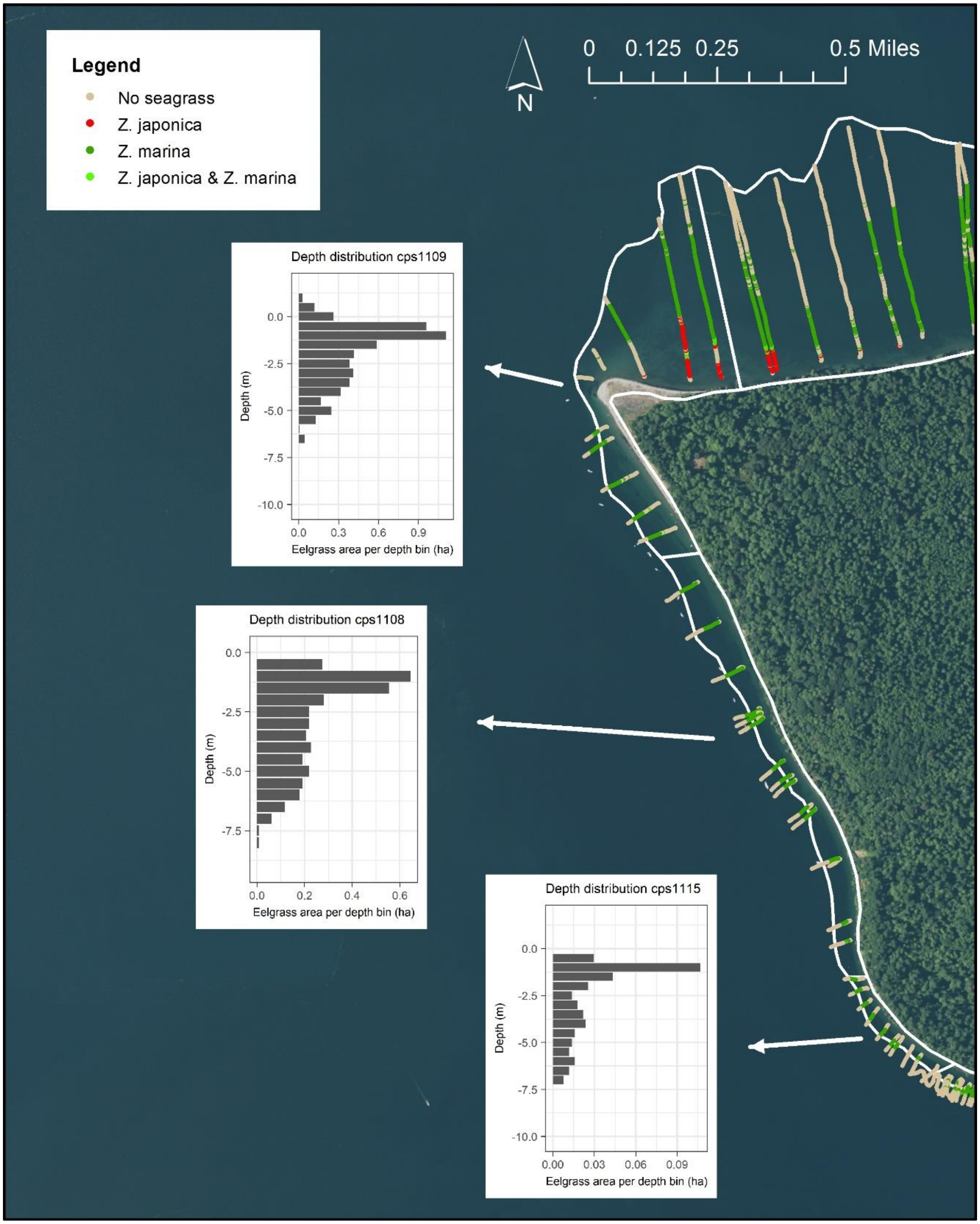
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0
0.125
0.25
0.5 Miles
N
Depth distribution cps2109
0.0
-2.5
-5.0
-7.5
Depth (m)
0.00
0.05
0.10
0.15
Eelgrass area per depth bin (ha)
cps2108: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2107: no seagrass
cps2106: no seagrass
cps2105: trace seagrass

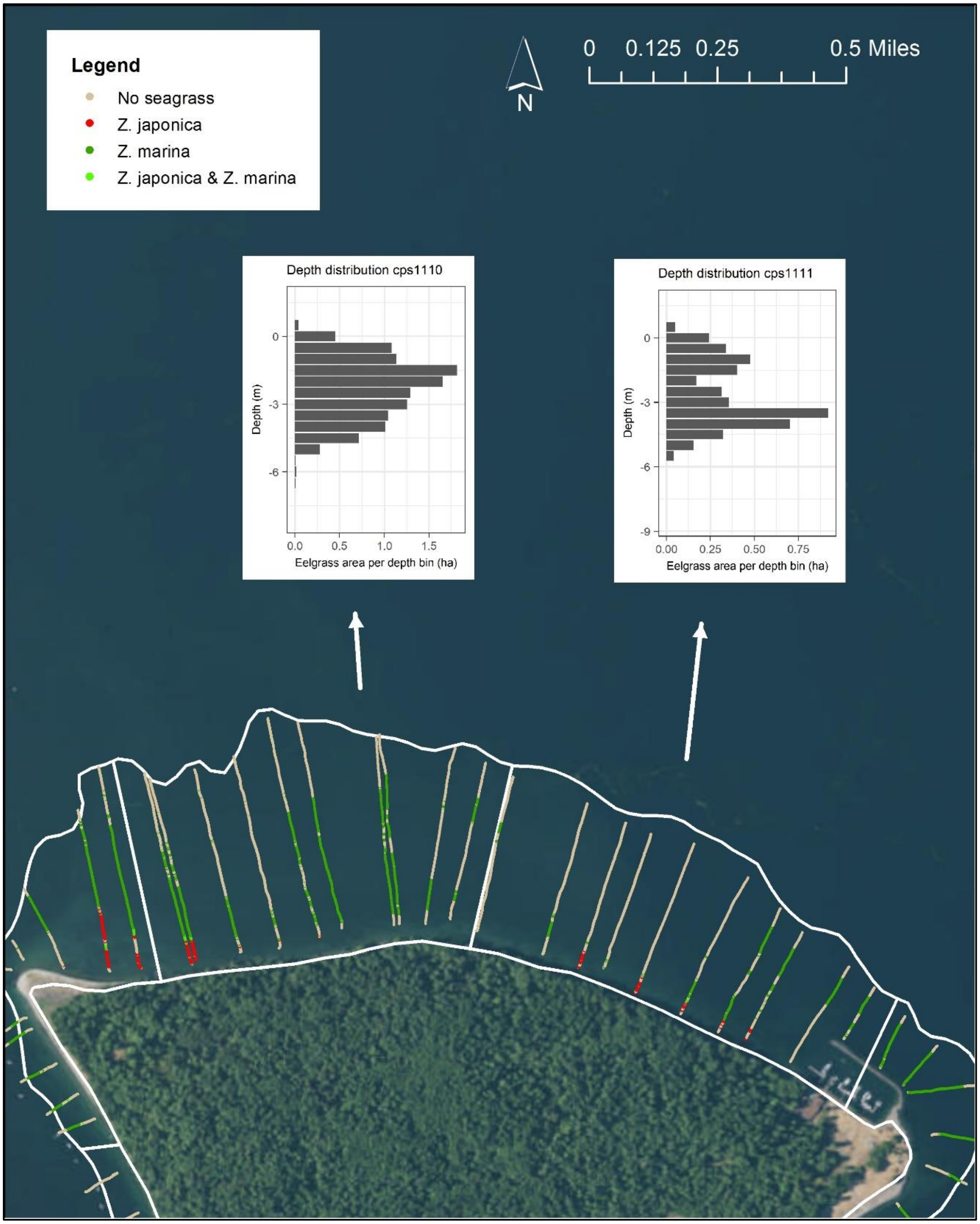

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps2104: no seagrass
Depth distribution cps2103
Depth (m)
Eelgrass area per depth bin (ha)
0
-2
-4
-6
-8
0.00 0.05 0.10 0.15 0.20



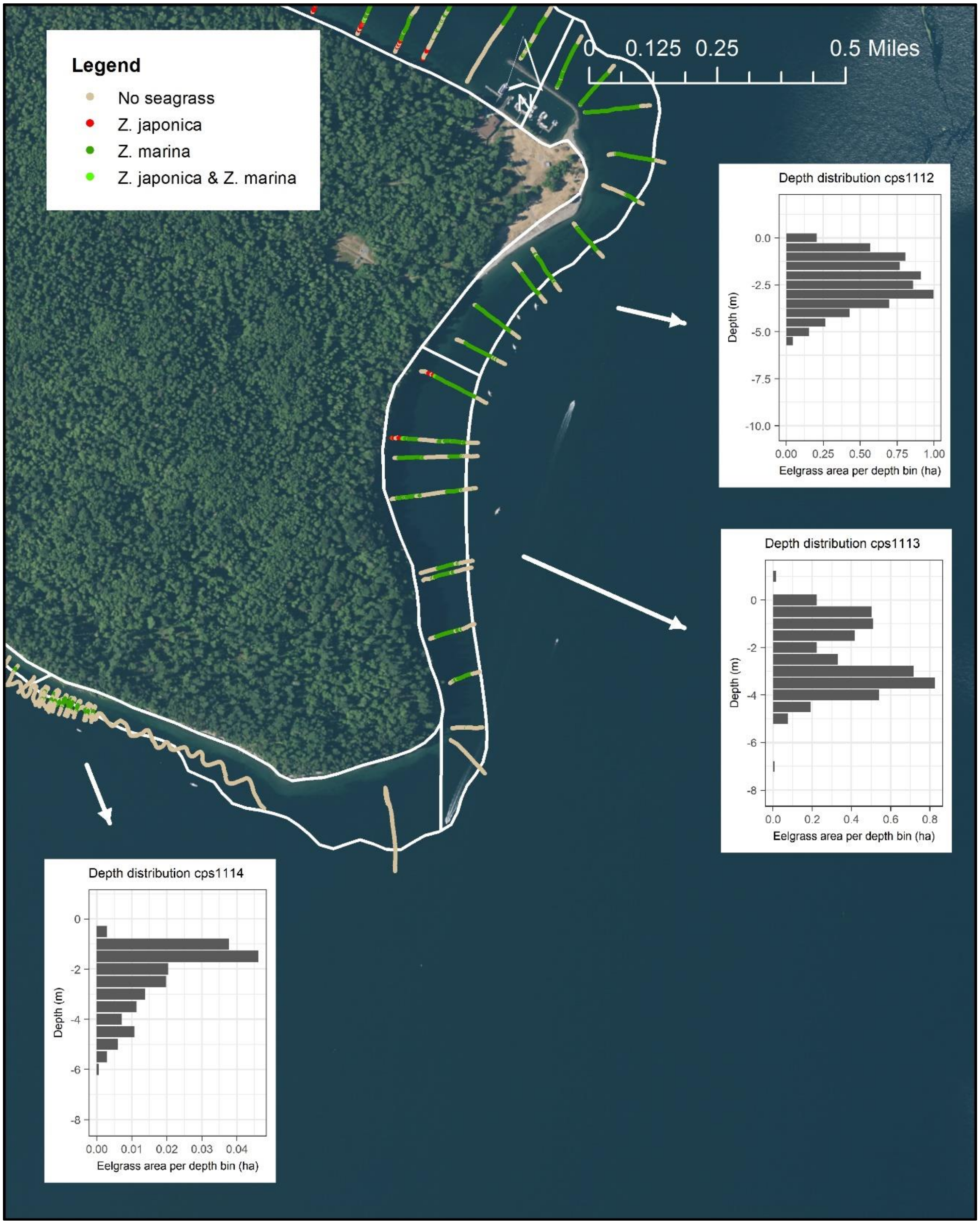
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2102
Depth (m)
Eelgrass area per depth bin (ha)
0
-2
-4
-6
-8
0.0 0.2 0.4 0.6
Depth distribution cps2101
Depth (m)
Eelgrass area per depth bin (ha)
0.0
-2.5
-5.0
-7.5
-10.0
0.00 0.25 0.50 0.75 1.00

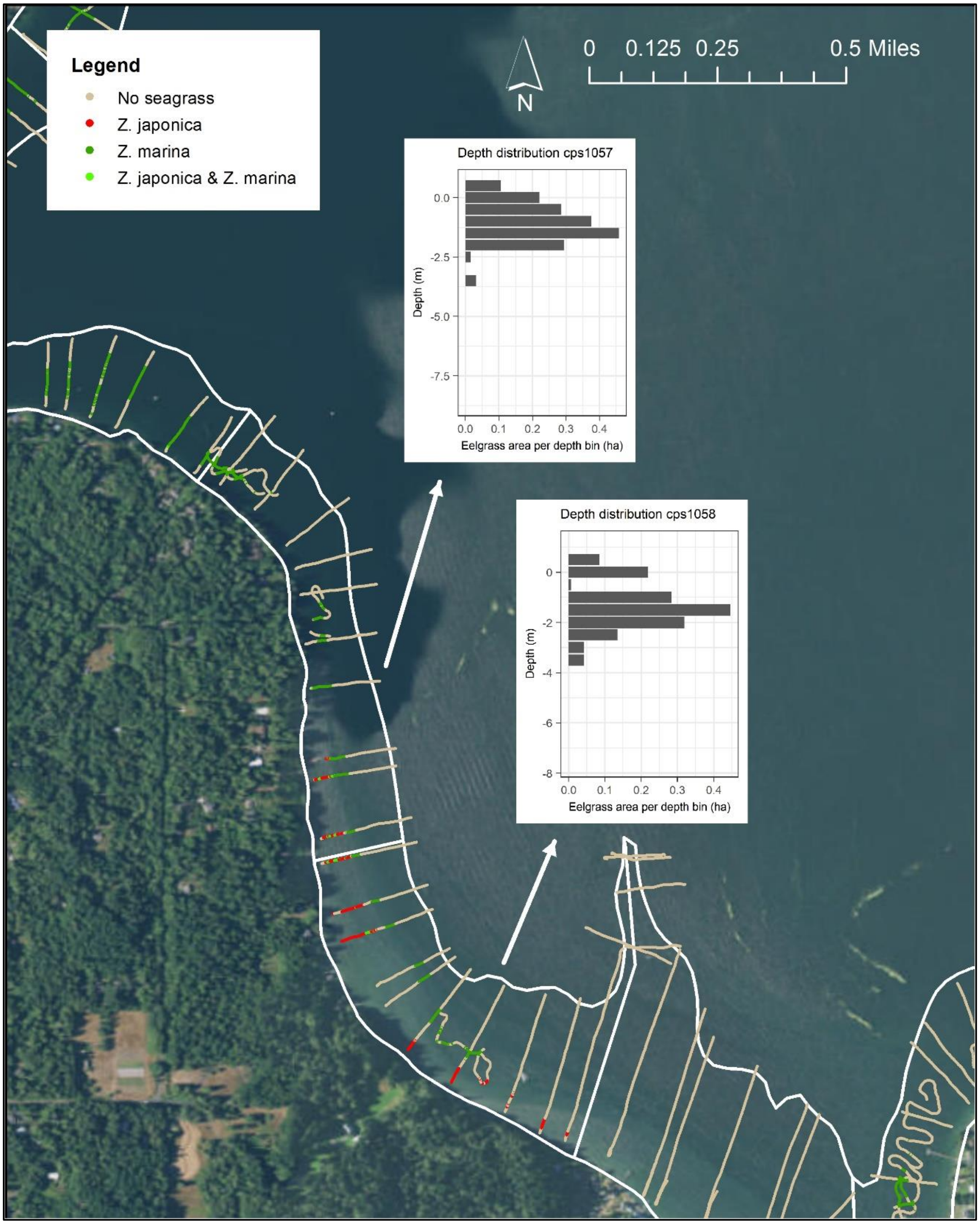


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1109
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1108
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1115
Depth (m)
Eelgrass area per depth bin (ha)

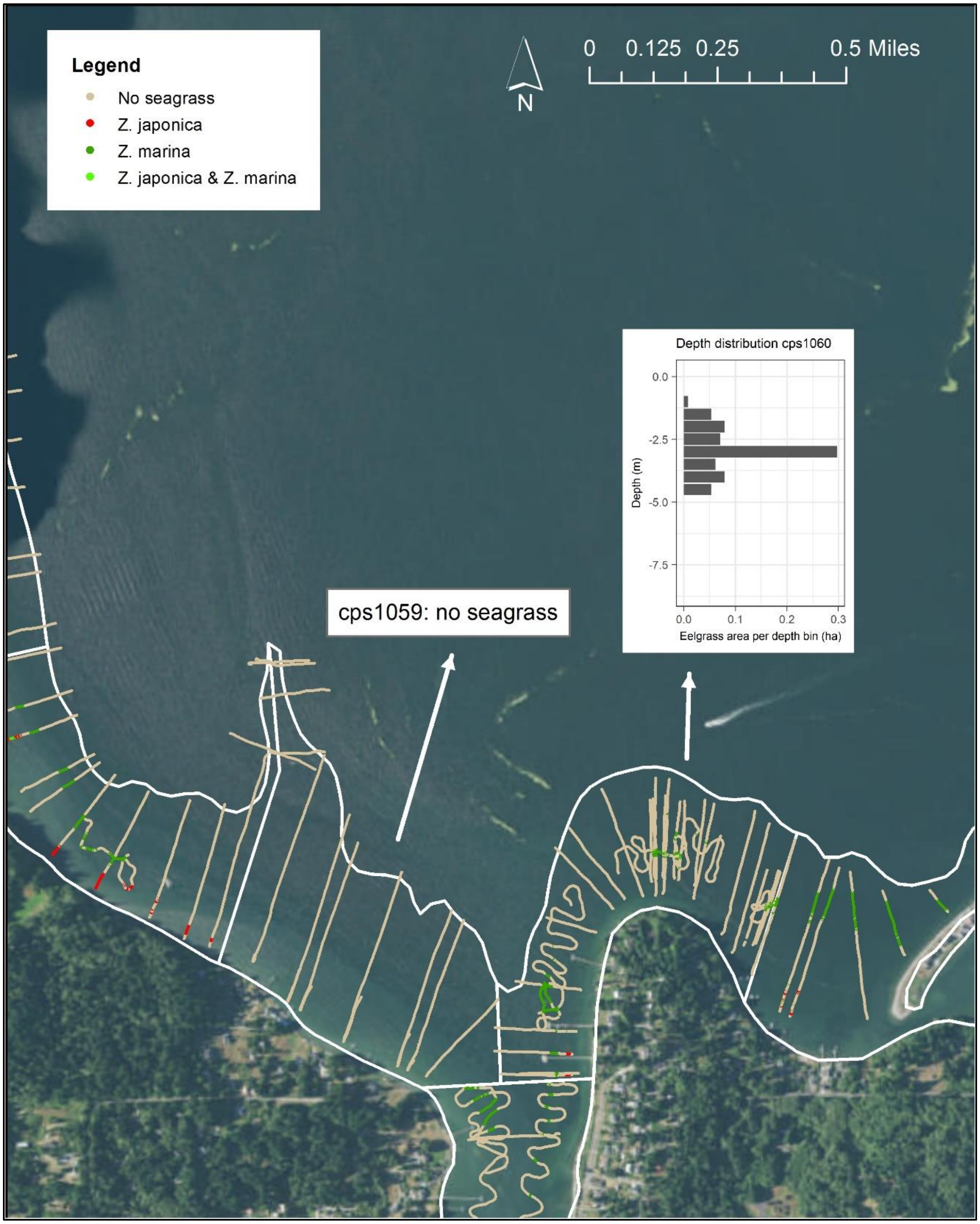


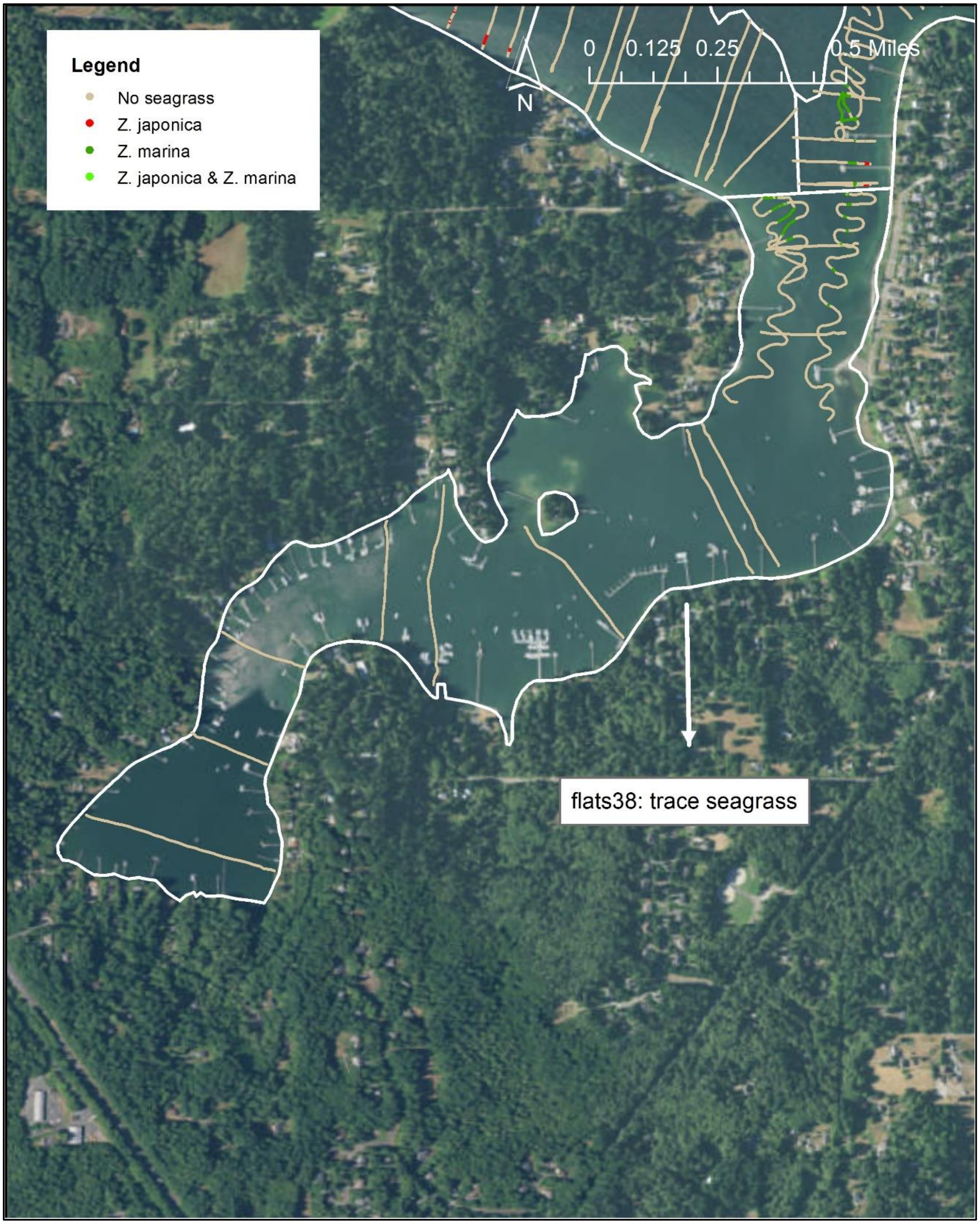
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1110
Depth (m)
0
-3
-6
0.0 0.5 1.0 1.5
Eelgrass area per depth bin (ha)
Depth distribution cps1111
Depth (m)
0
-3
-6
-9
0.00 0.25 0.50 0.75
Eelgrass area per depth bin (ha)

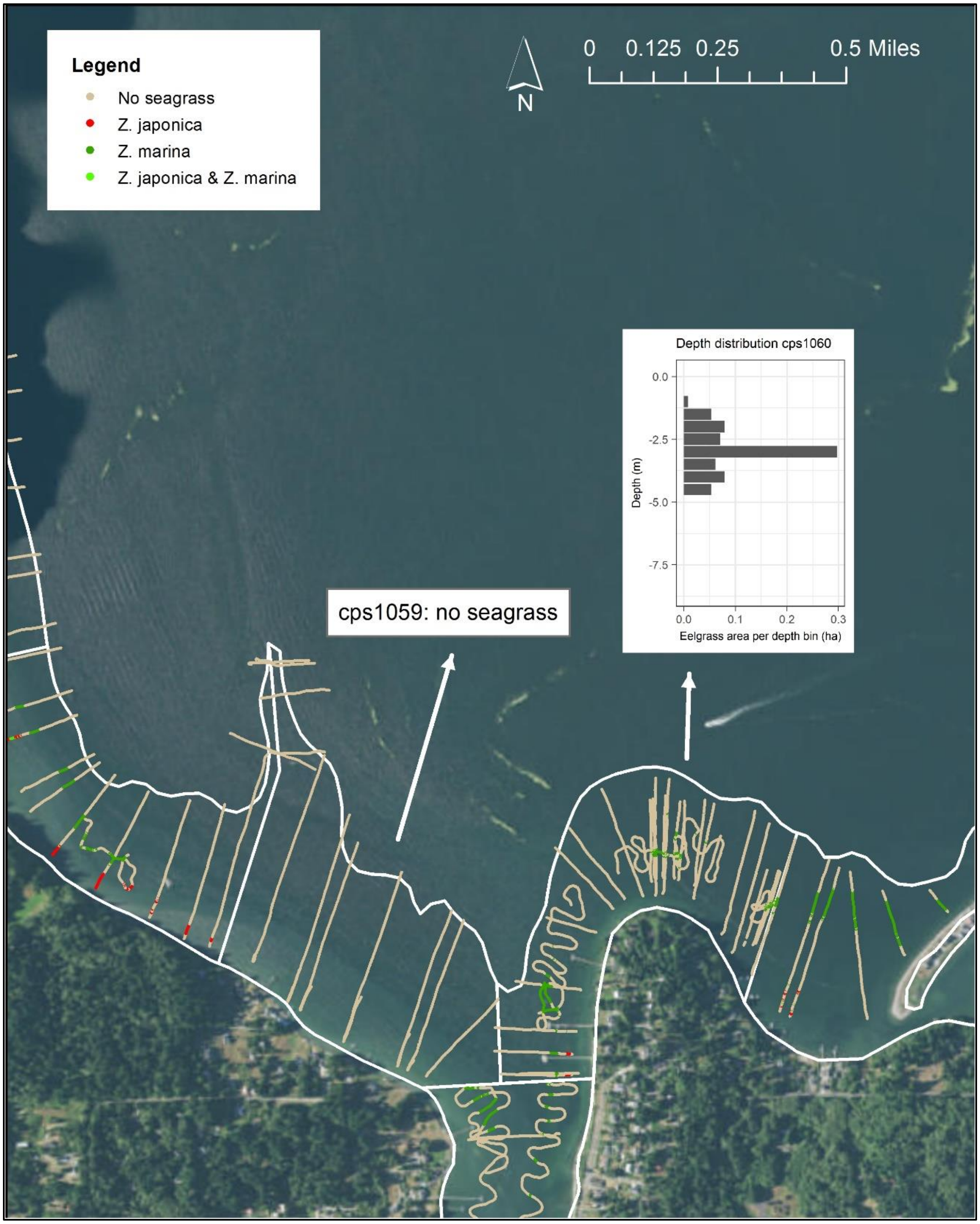

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
Depth distribution cps1112
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1113
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1114
Depth (m)
Eelgrass area per depth bin (ha)



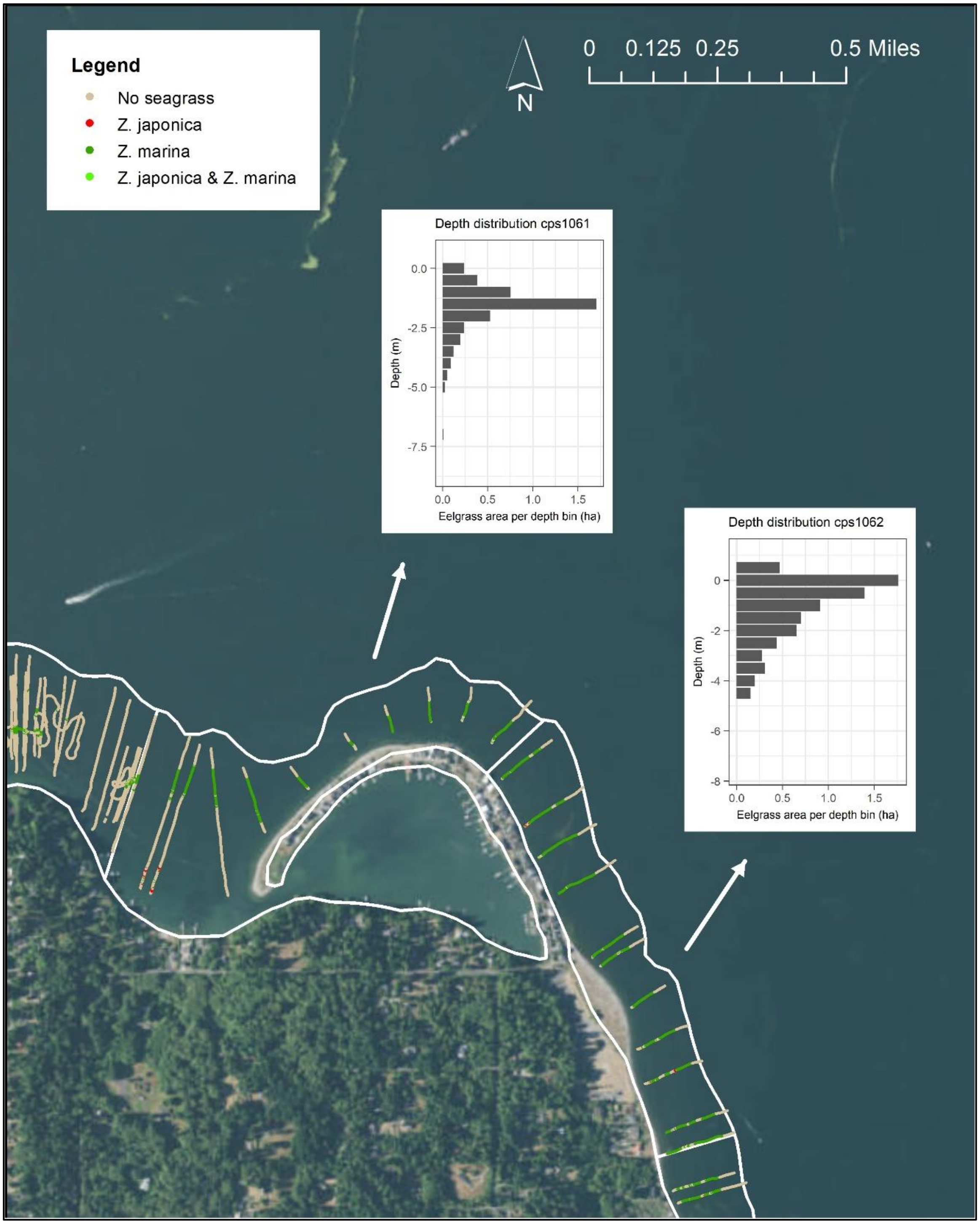
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution cps1057
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1058
Depth (m)
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
cps1059: no seagrass
Depth distribution cps1060
0.0
-2.5
-5.0
-7.5
Depth (m)
0.0
0.1
0.2
0.3
Eelgrass area per depth bin (ha)

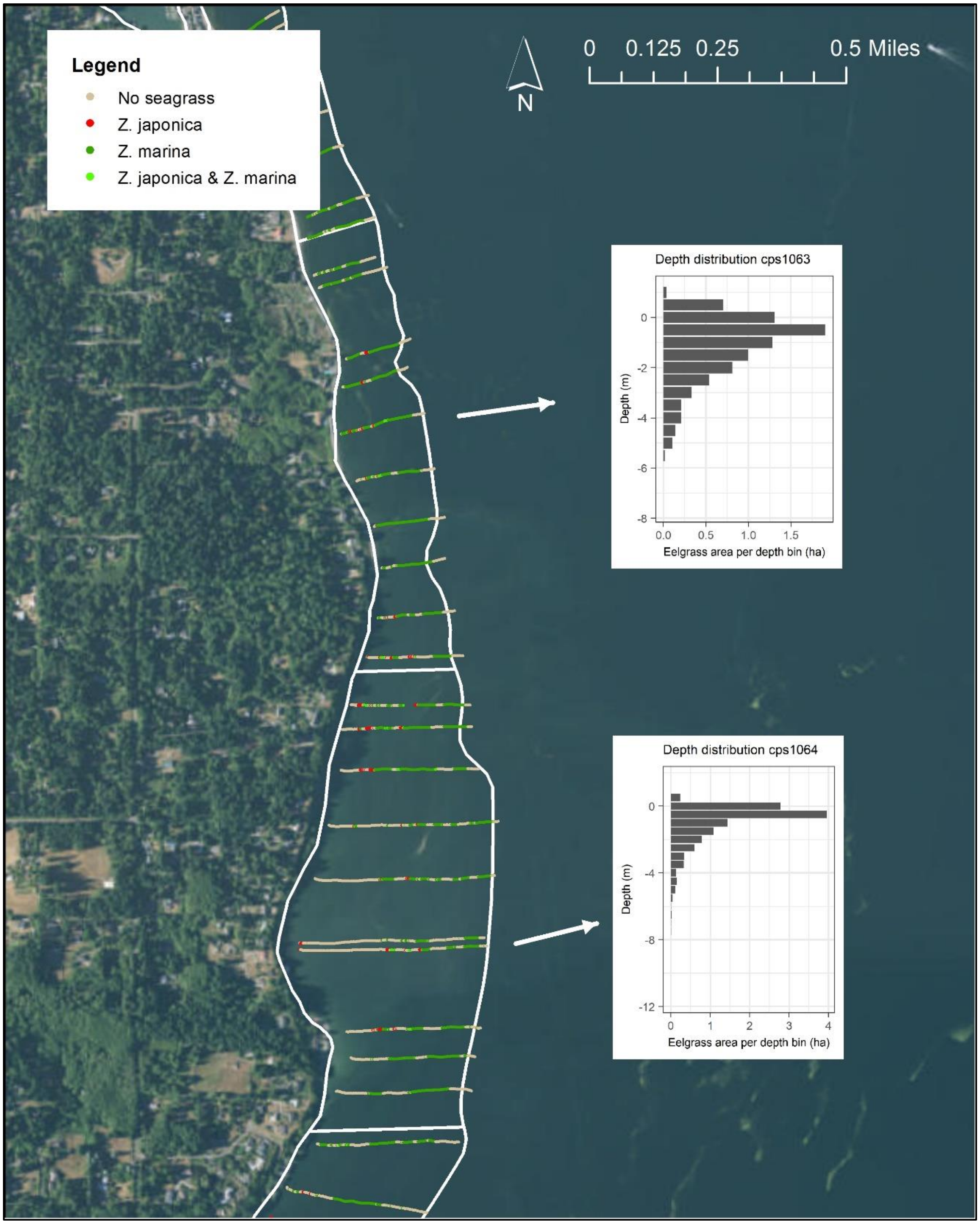

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0
0.125
0.25
0.5 Miles
N
flats38: trace seagrass



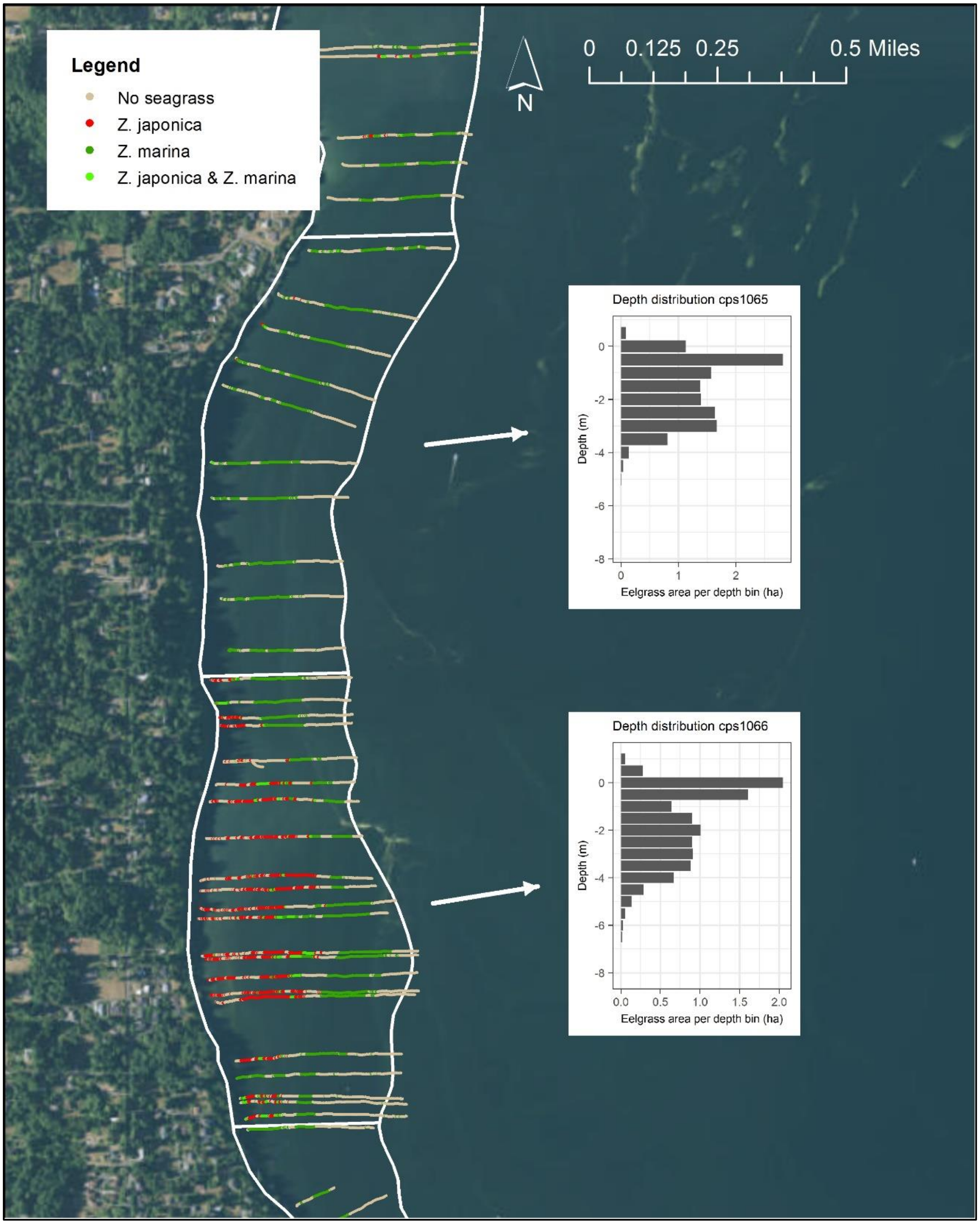
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1059: no seagrass
Depth distribution cps1060
0.0
-2.5
-5.0
-7.5
Depth (m)
0.0 0.1 0.2 0.3
Eelgrass area per depth bin (ha)

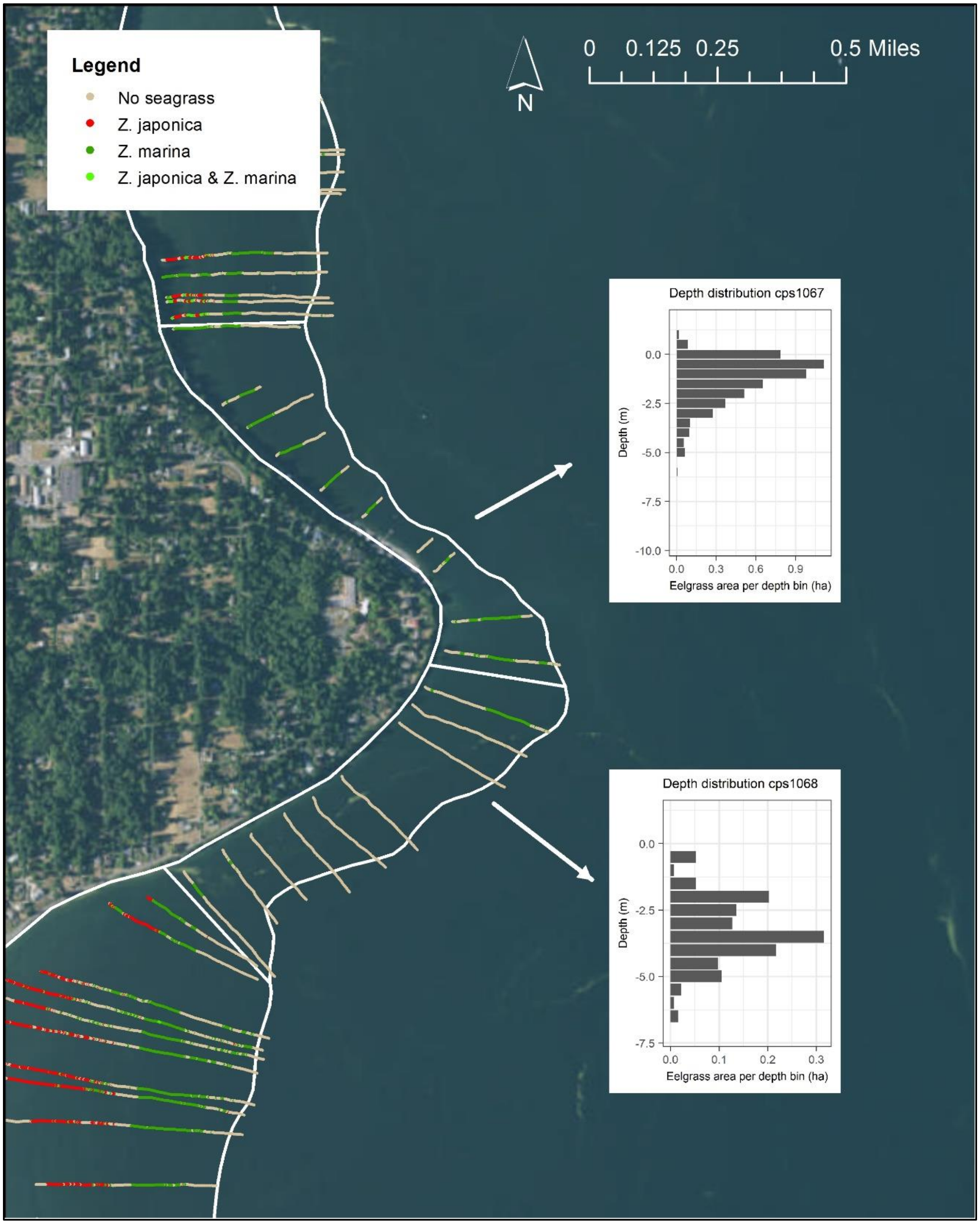


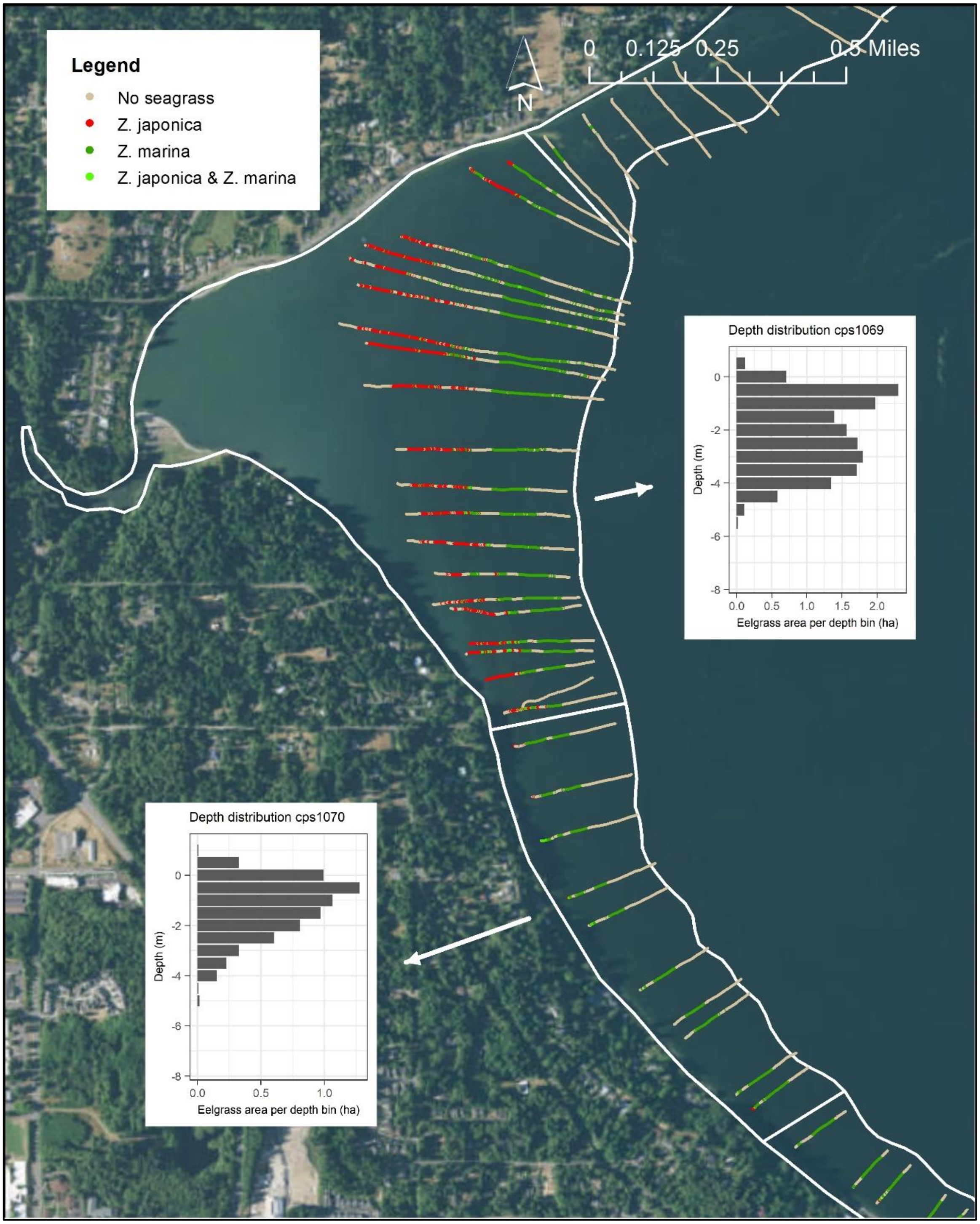
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1061
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1062
Depth (m)
Eelgrass area per depth bin (ha)

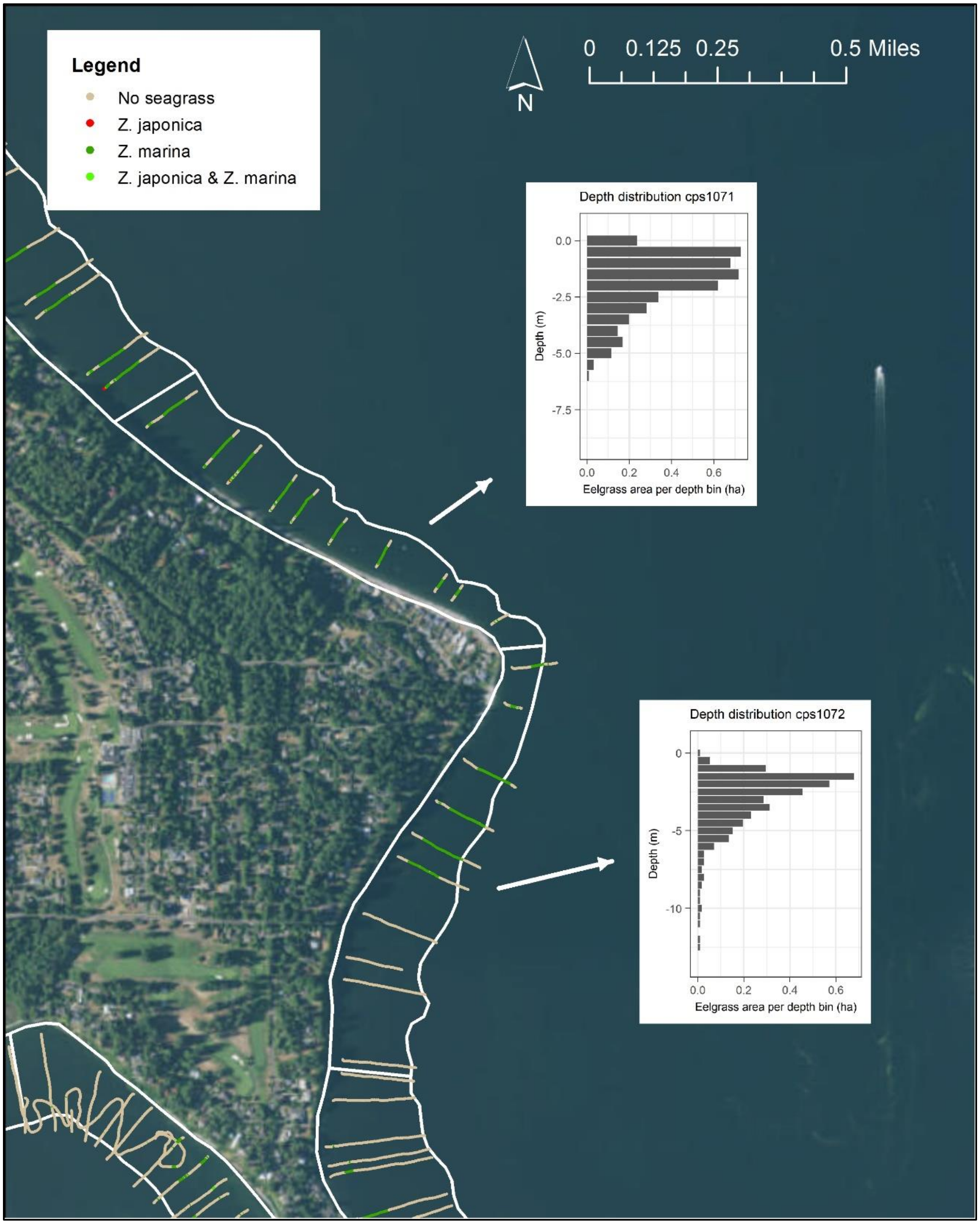


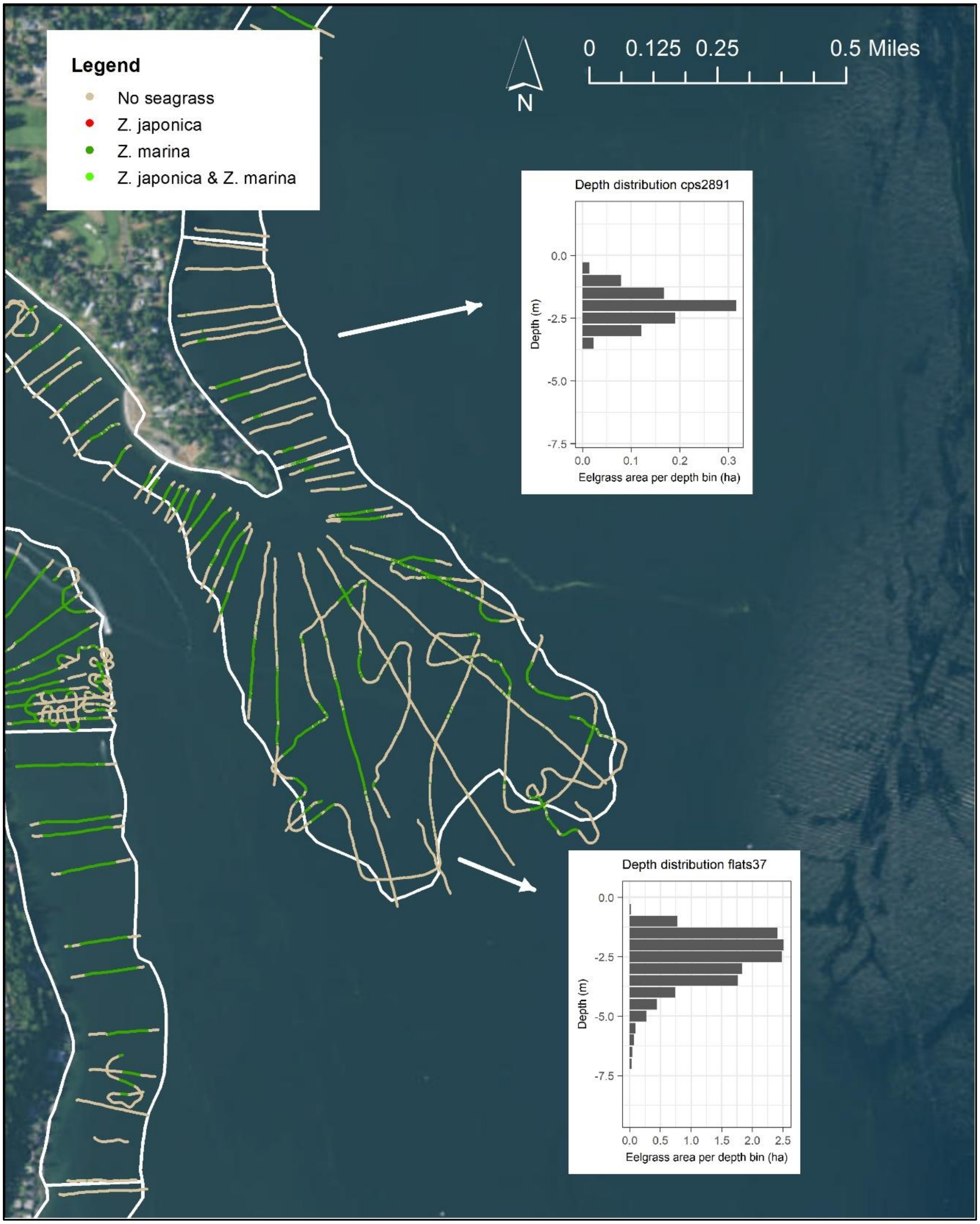
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1063
Depth (m)
0
-2
-4
-6
-8
0.0 0.5 1.0 1.5
Eelgrass area per depth bin (ha)
Depth distribution cps1064
Depth (m)
0
-4
-8
-12
0 1 2 3 4
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1065
Depth (m)
0
-2
-4
-6
-8
0 1 2
Eelgrass area per depth bin (ha)
Depth distribution cps1066
Depth (m)
0
-2
-4
-6
-8
0.0 0.5 1.0 1.5 2.0
Eelgrass area per depth bin (ha)

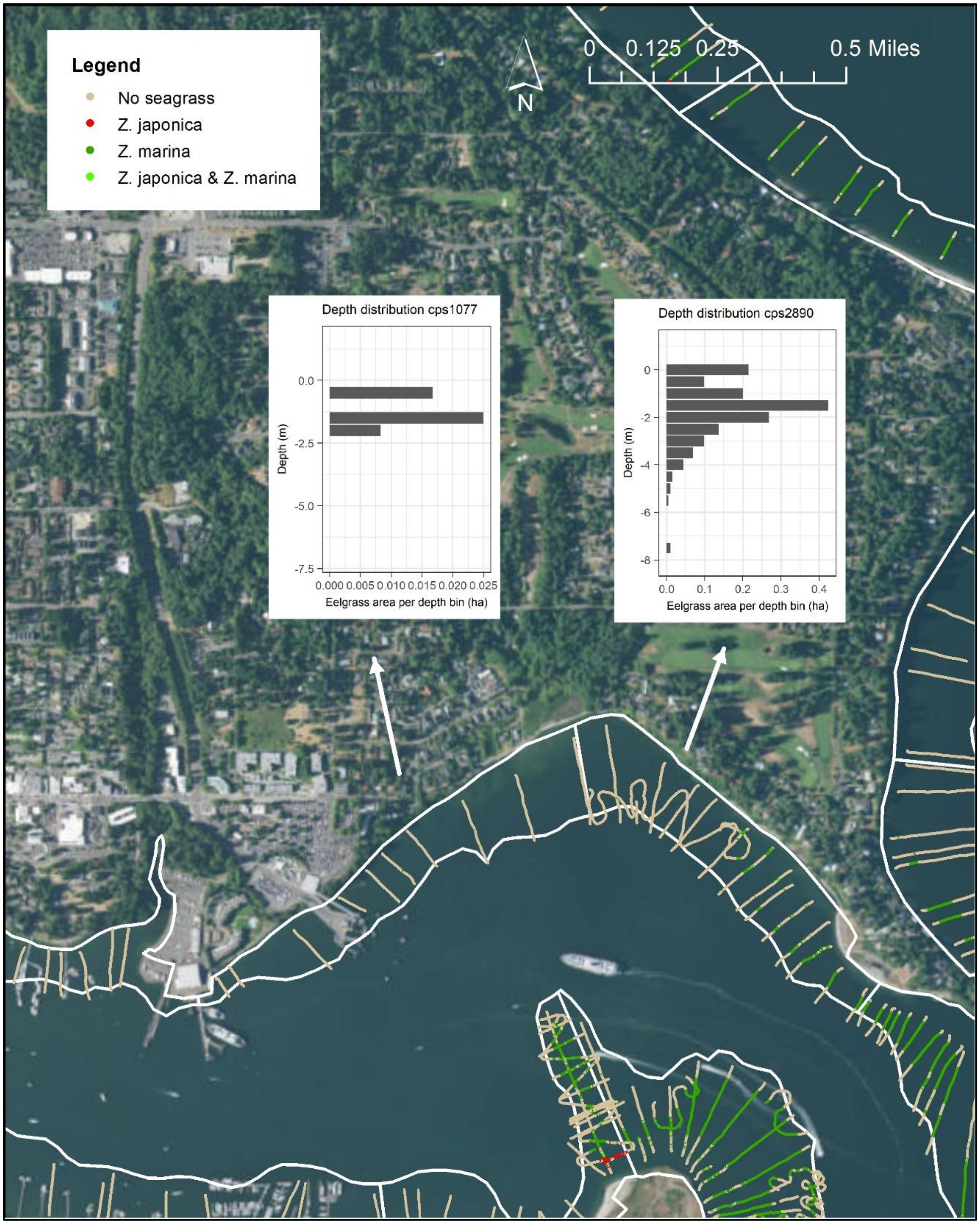

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1067
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1068
Depth (m)
Eelgrass area per depth bin (ha)

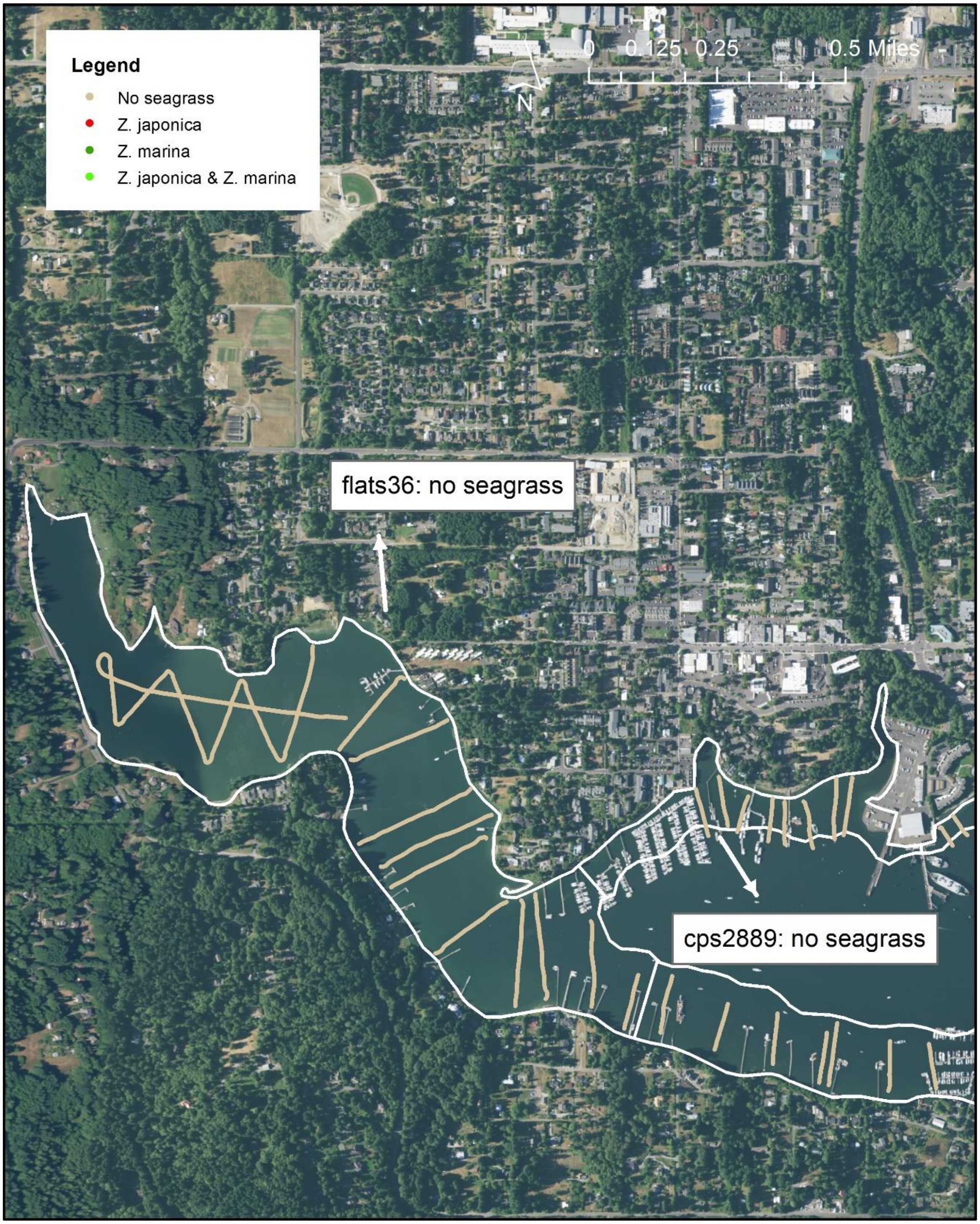

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1069
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1070
Depth (m)
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1071
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)
Depth distribution cps1072
Depth (m)
0
-5
-10
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)

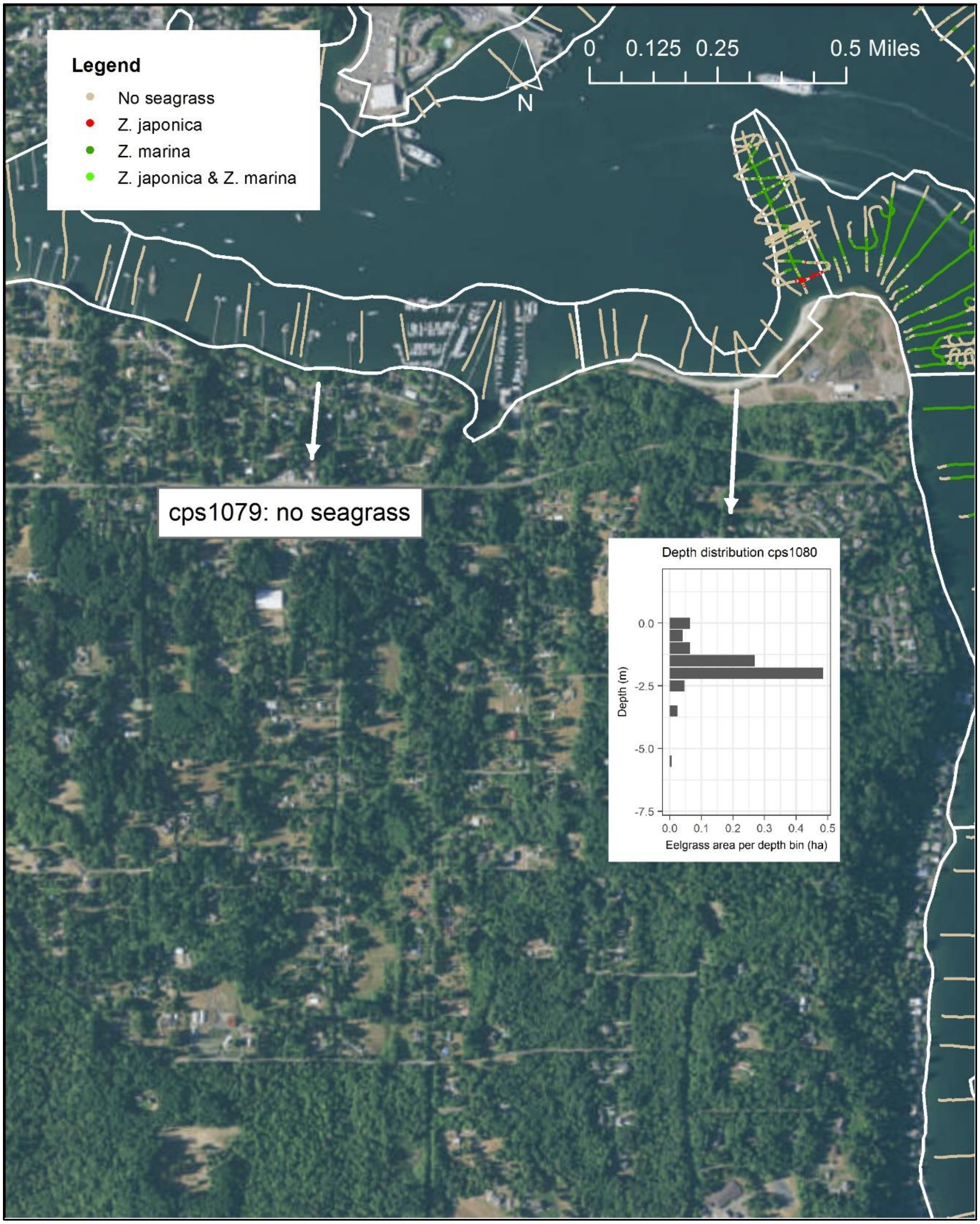


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps2891
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution flats37
Depth (m)
Eelgrass area per depth bin (ha)

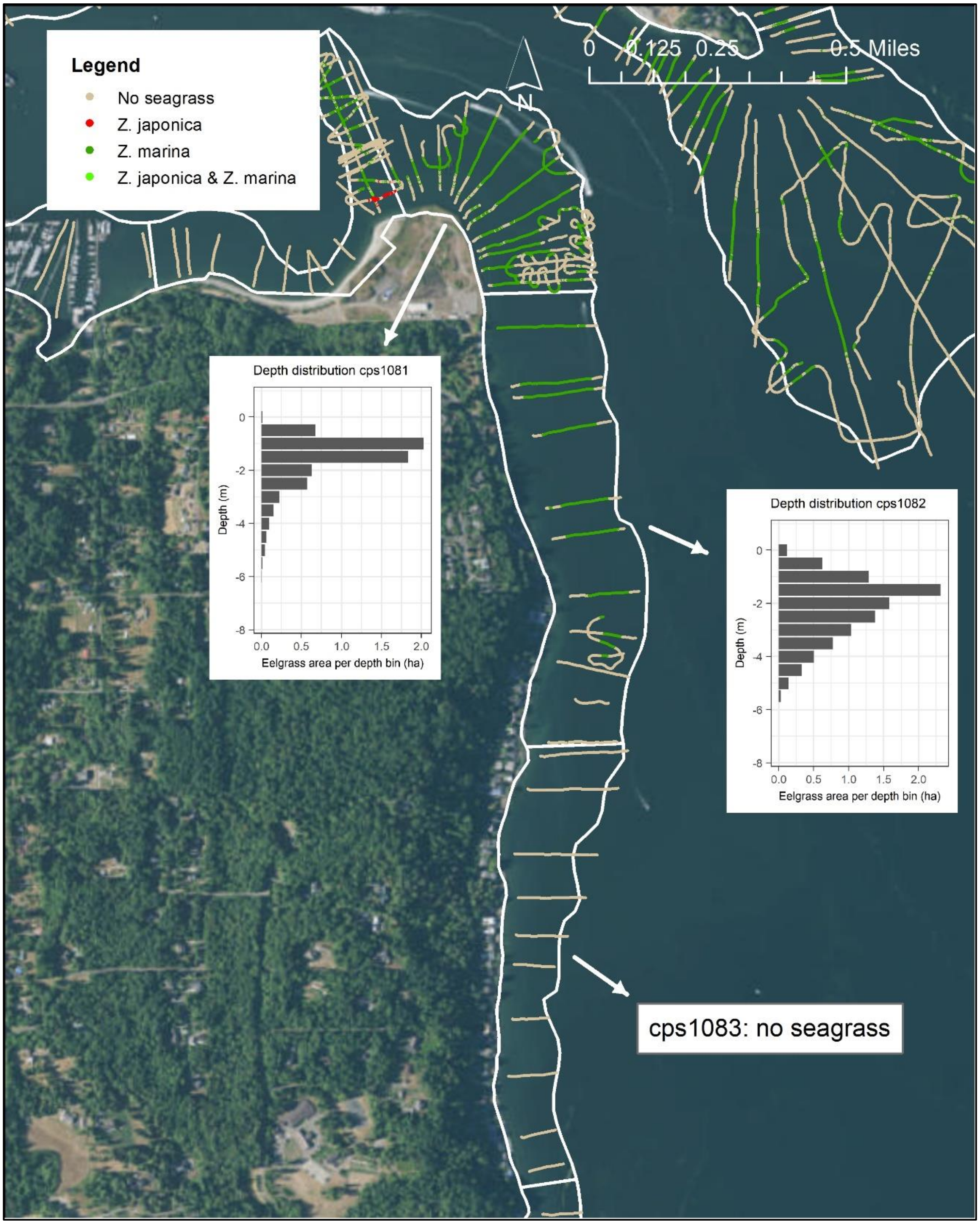

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1077
Depth (m)
0.0
-2.5
-5.0
-7.5
0.000 0.005 0.010 0.015 0.020 0.025
Eelgrass area per depth bin (ha)
Depth distribution cps2890
Depth (m)
0
-2
-4
-6
-8
0.0 0.1 0.2 0.3 0.4
Eelgrass area per depth bin (ha)



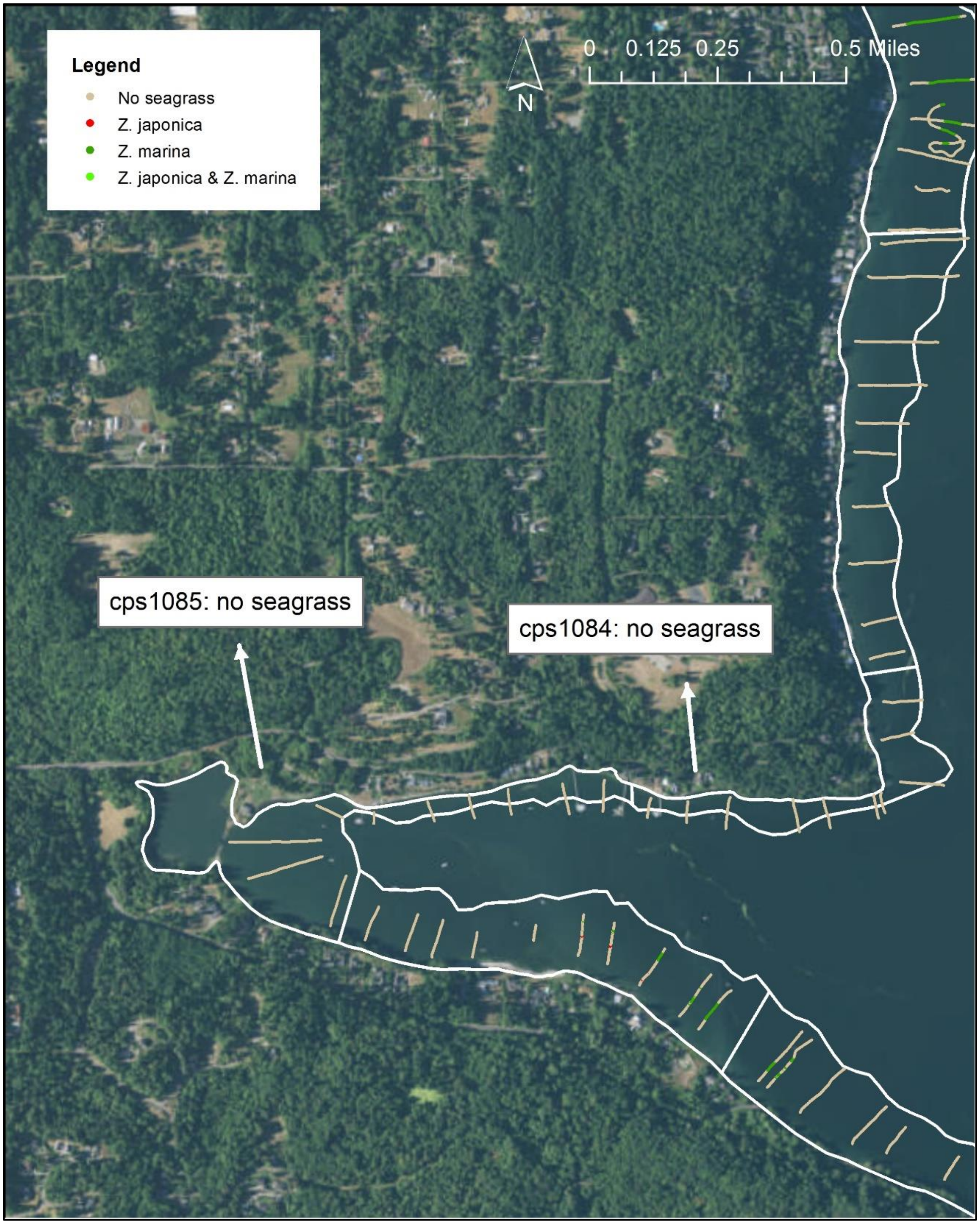
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
flats36: no seagrass
cps2889: no seagrass

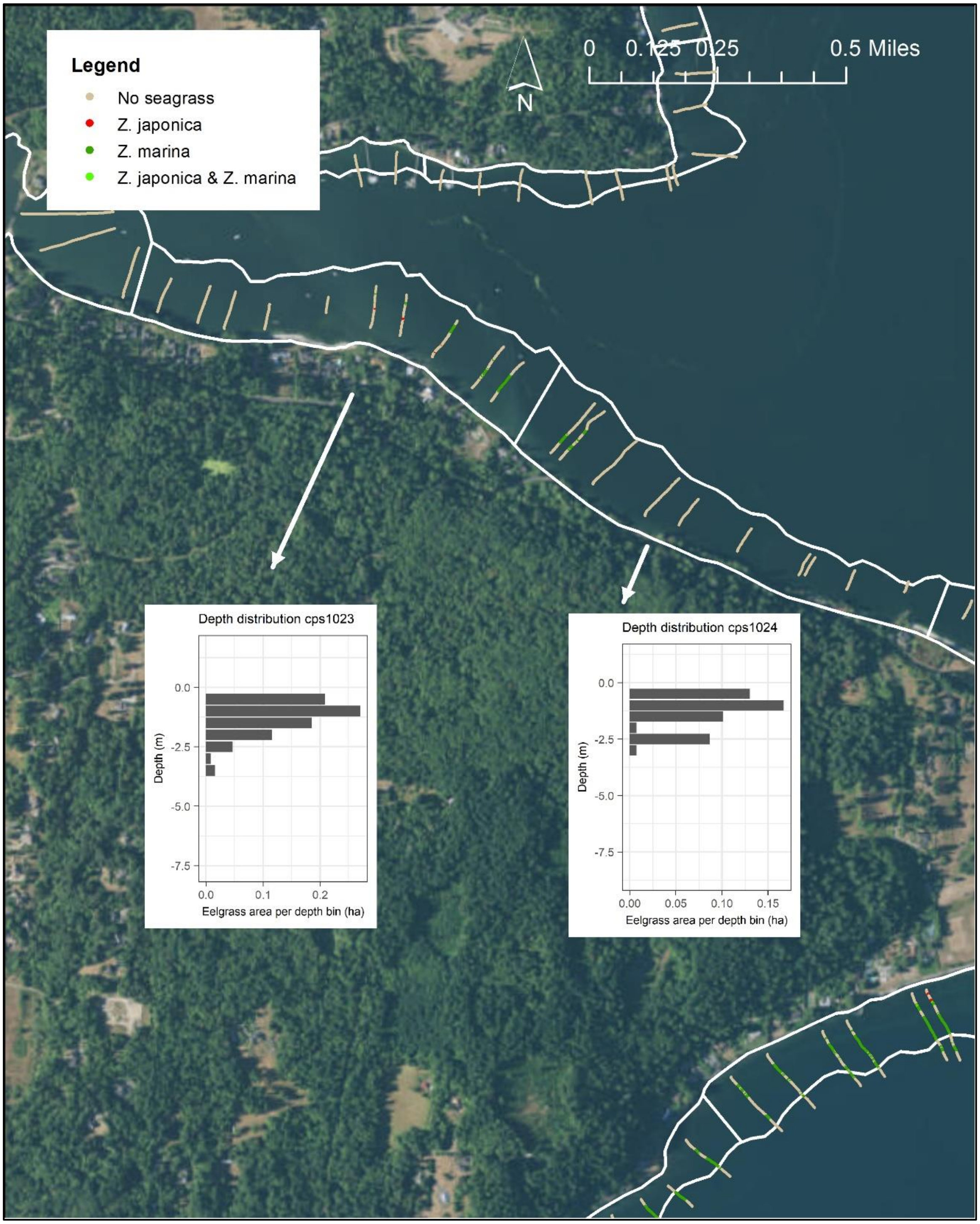


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0
0.125
0.25
0.5 Miles
N
cps1079: no seagrass
Depth distribution cps1080
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0
0.1
0.2
0.3
0.4
0.5
Eelgrass area per depth bin (ha)

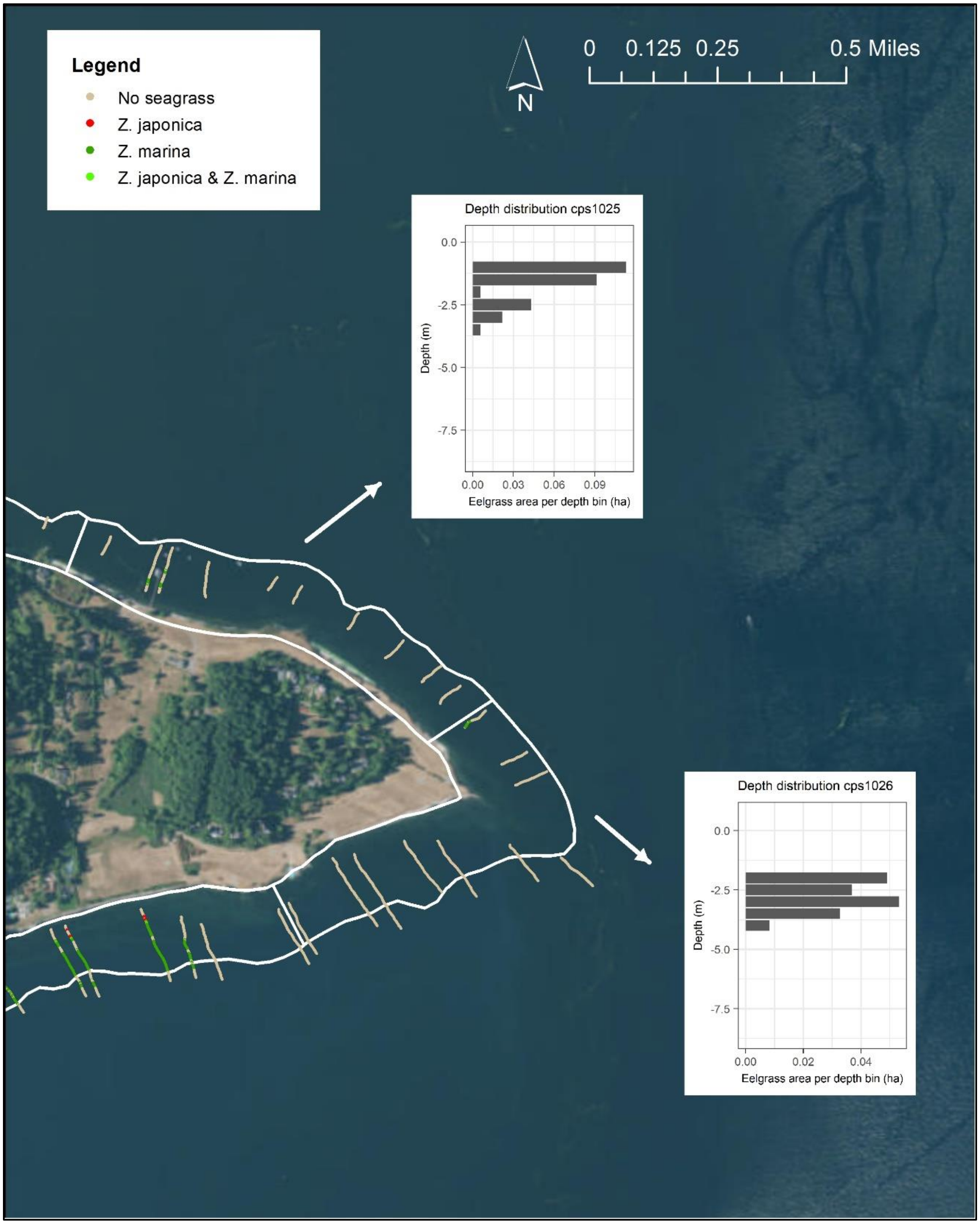


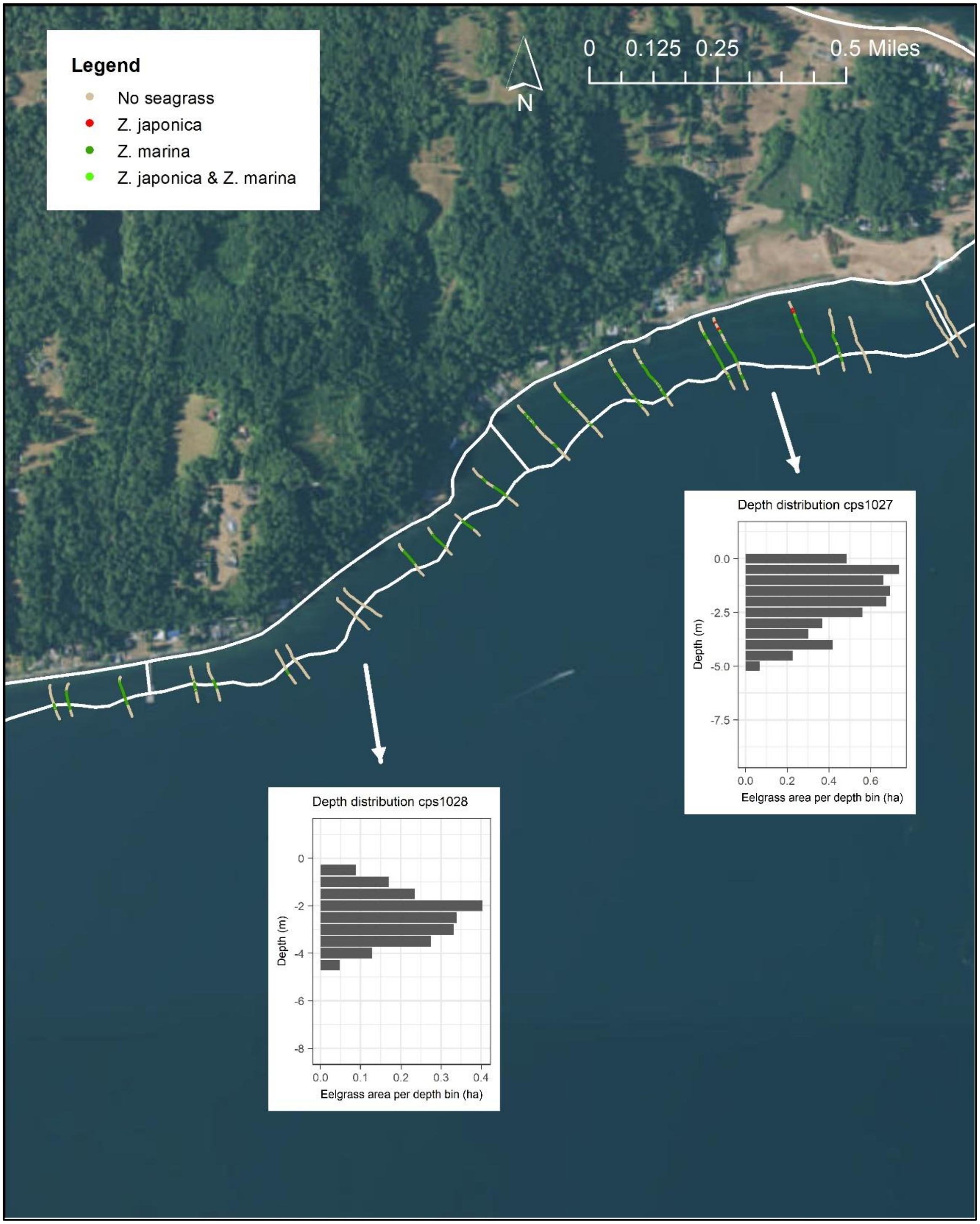
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1081
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1082
Depth (m)
Eelgrass area per depth bin (ha)
cps1083: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1085: no seagrass
cps1084: no seagrass

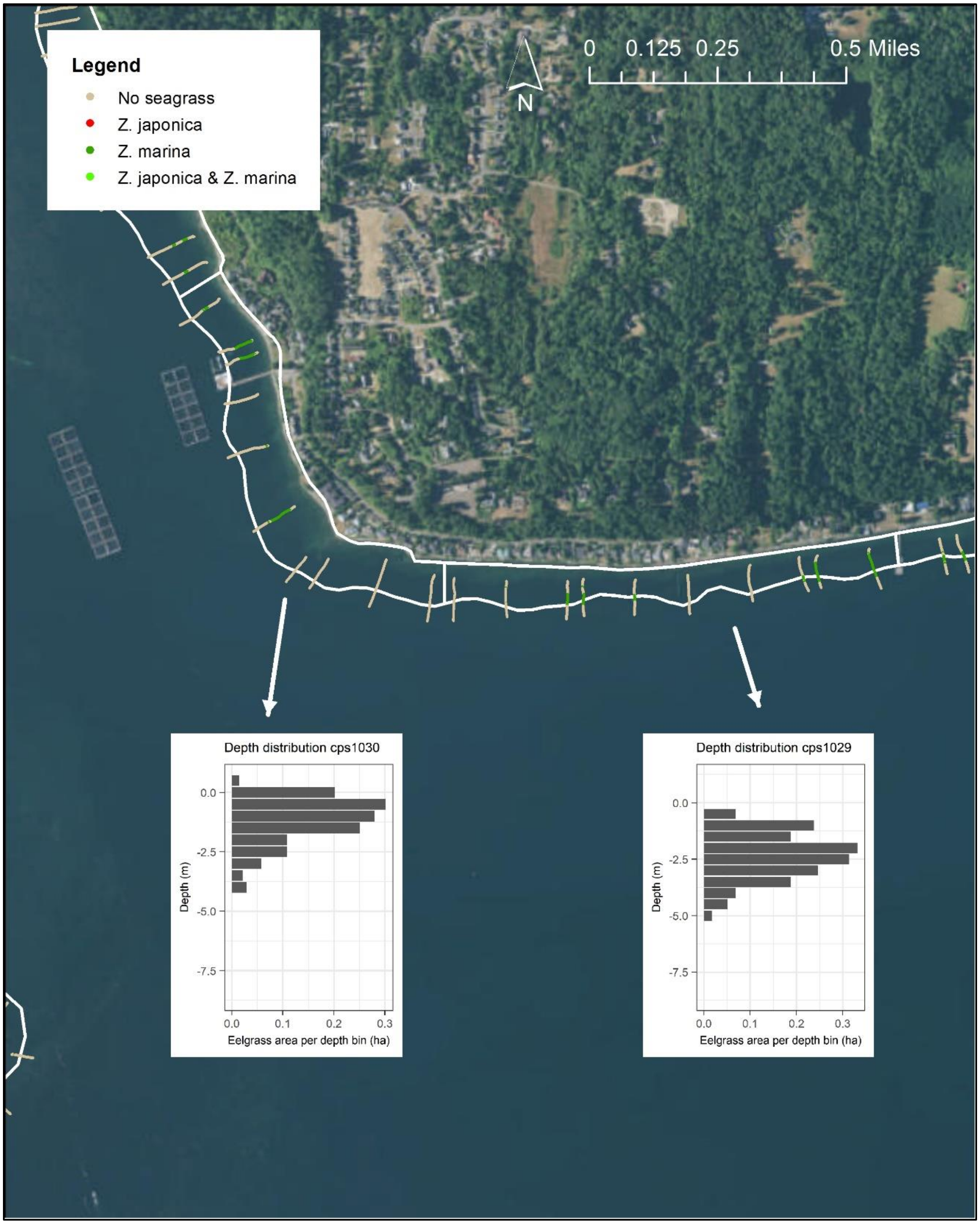


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1023
Depth (m)
Eelgrass area per depth bin (ha)
0.0
-2.5
-5.0
-7.5
0.0 0.1 0.2
Depth distribution cps1024
Depth (m)
Eelgrass area per depth bin (ha)
0.0
-2.5
-5.0
-7.5
0.00 0.05 0.10 0.15

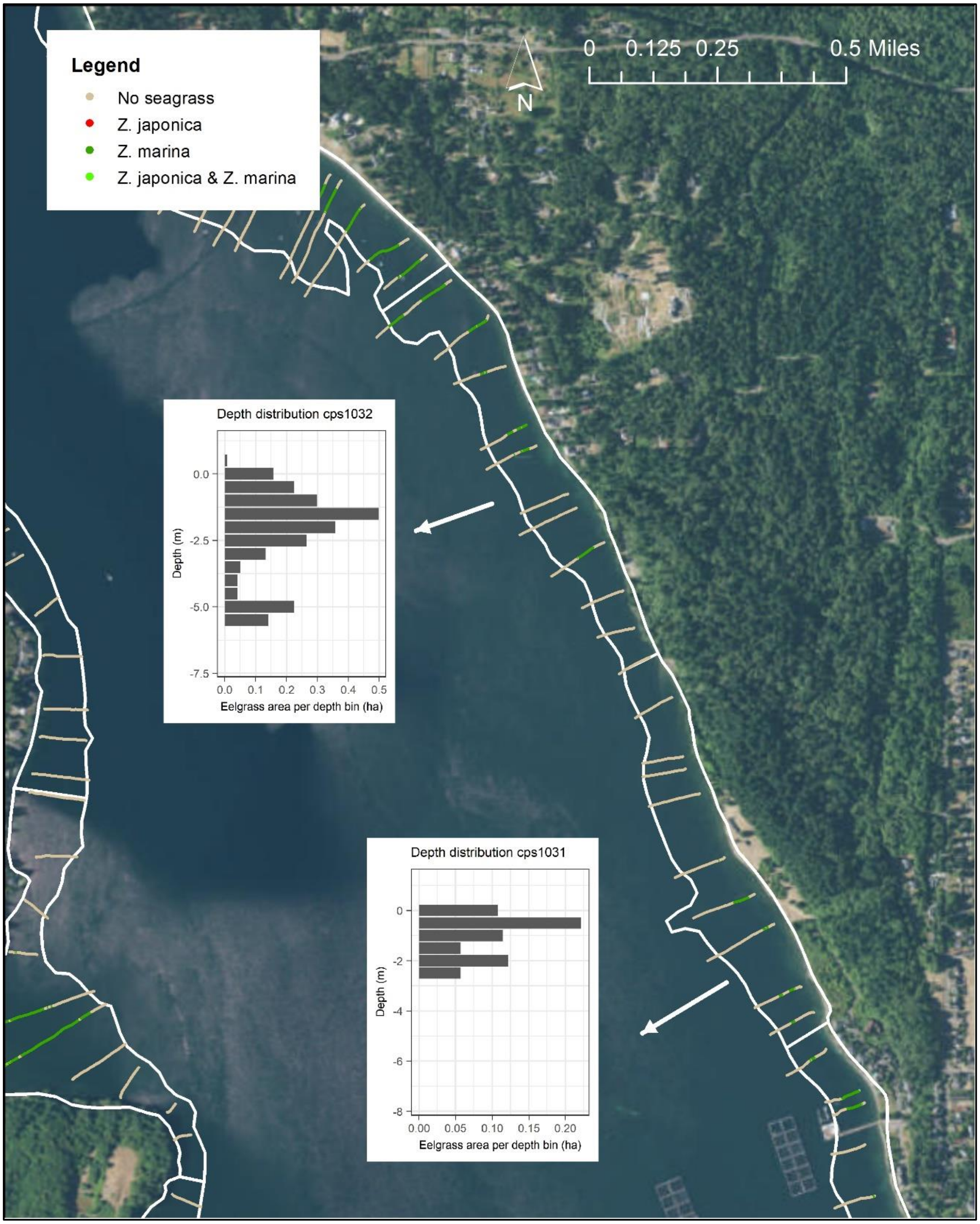

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1025
0.0
-2.5
-5.0
-7.5
Depth (m)
0.00 0.03 0.06 0.09
Eelgrass area per depth bin (ha)
Depth distribution cps1026
0.0
-2.5
-5.0
-7.5
Depth (m)
0.00 0.02 0.04
Eelgrass area per depth bin (ha)



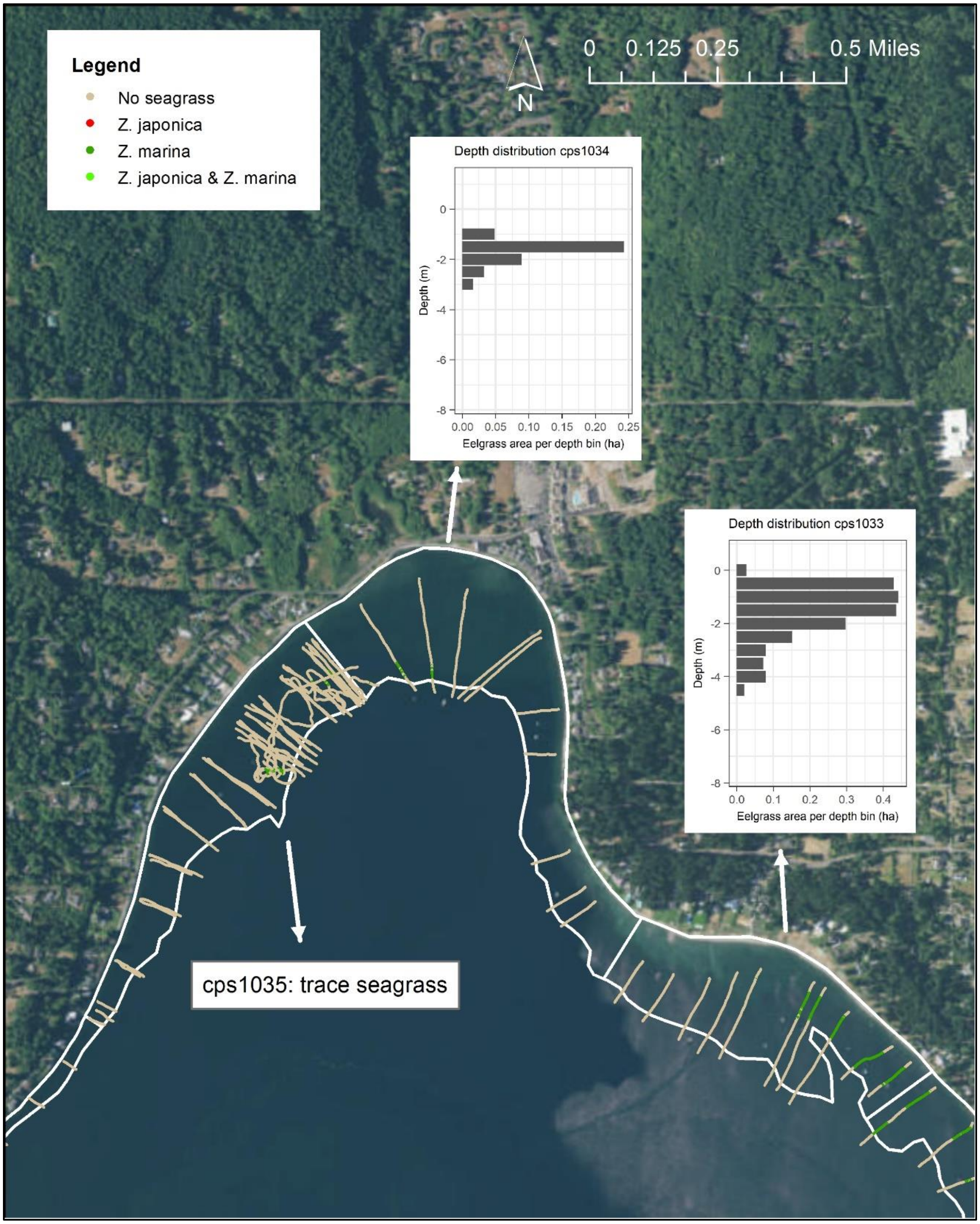
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1027
0.0
-2.5
-5.0
-7.5
Depth (m)
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)
Depth distribution cps1028
0
-2
-4
-6
-8
Depth (m)
0.0 0.1 0.2 0.3 0.4
Eelgrass area per depth bin (ha)



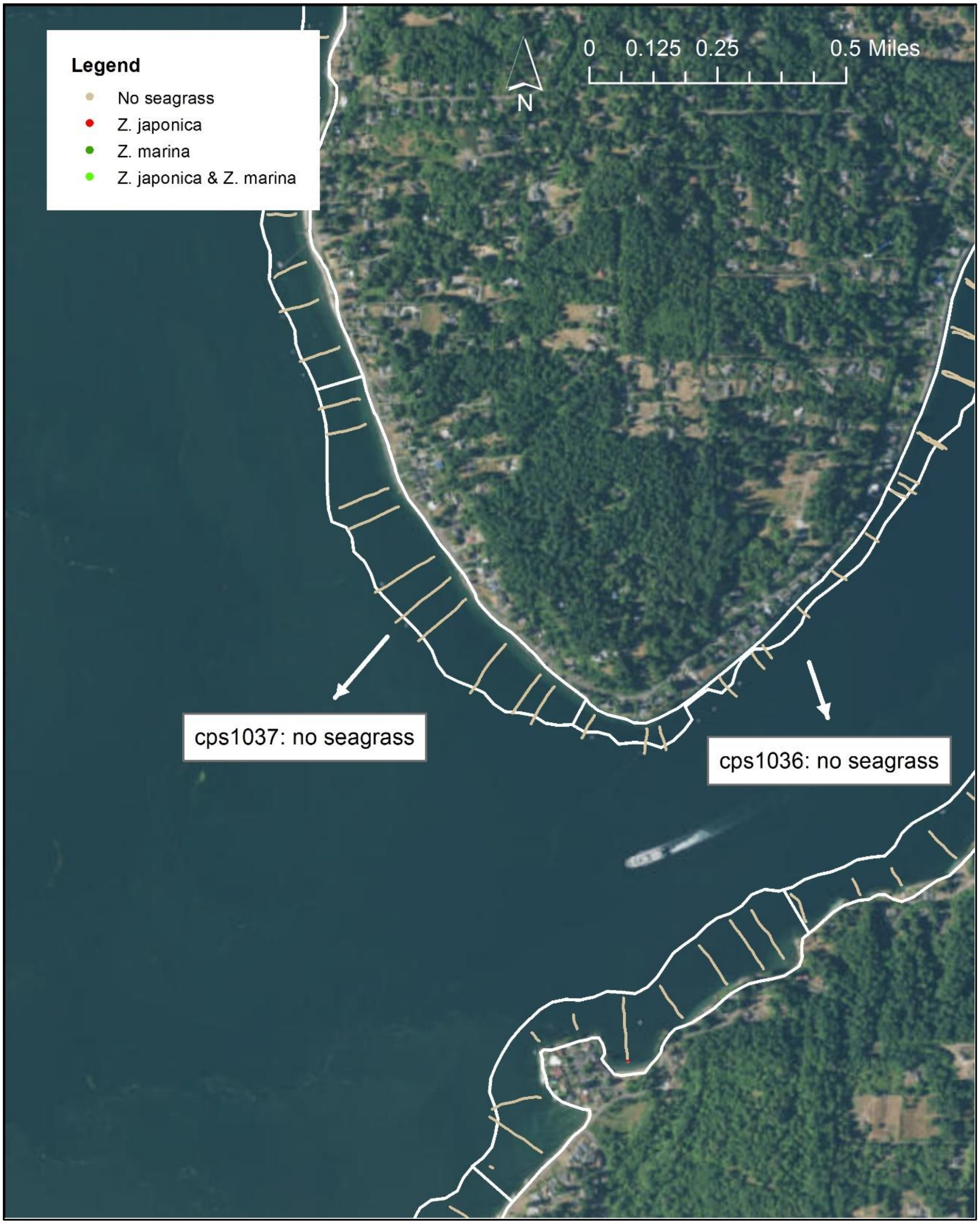
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1030
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1029
Depth (m)
Eelgrass area per depth bin (ha)



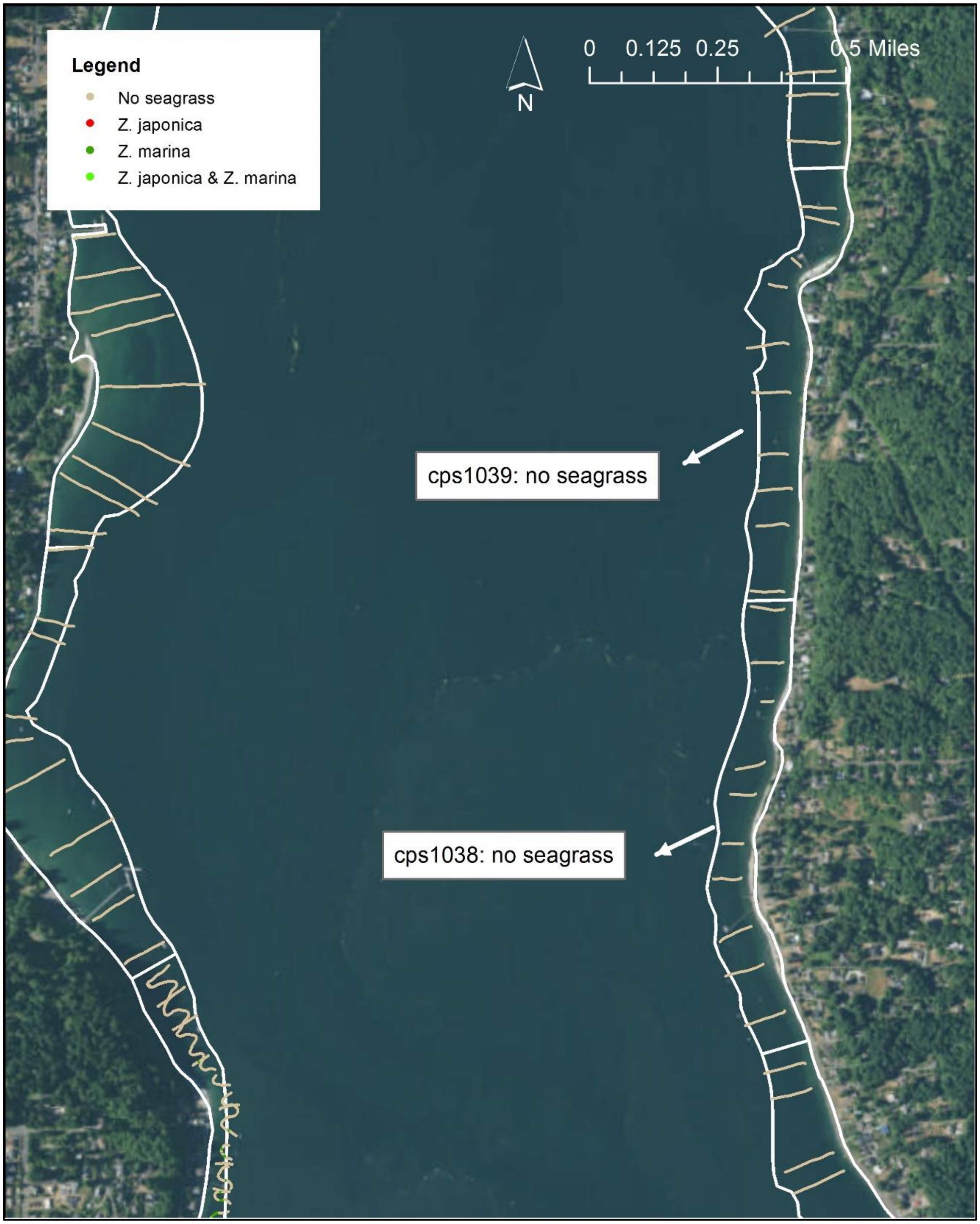
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1032
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.1 0.2 0.3 0.4 0.5
Eelgrass area per depth bin (ha)
Depth distribution cps1031
Depth (m)
0
-2
-4
-6
-8
0.00 0.05 0.10 0.15 0.20
Eelgrass area per depth bin (ha)

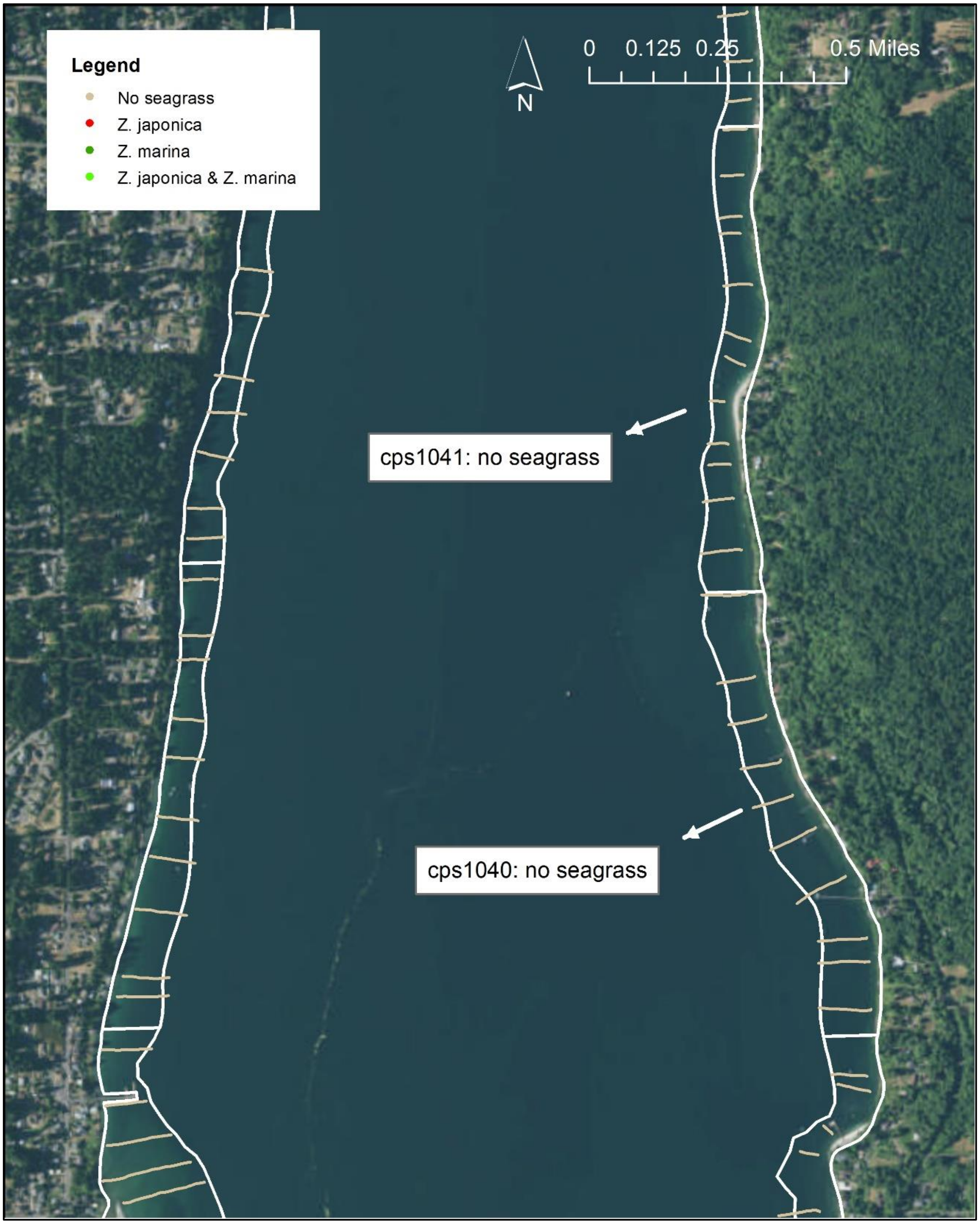


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
Depth distribution cps1034
Depth (m)
Eelgrass area per depth bin (ha)
0
-2
-4
-6
-8
0.00
0.05
0.10
0.15
0.20
0.25
Depth distribution cps1033
Depth (m)
Eelgrass area per depth bin (ha)
0
-2
-4
-6
-8
0.0
0.1
0.2
0.3
0.4
cps1035: trace seagrass

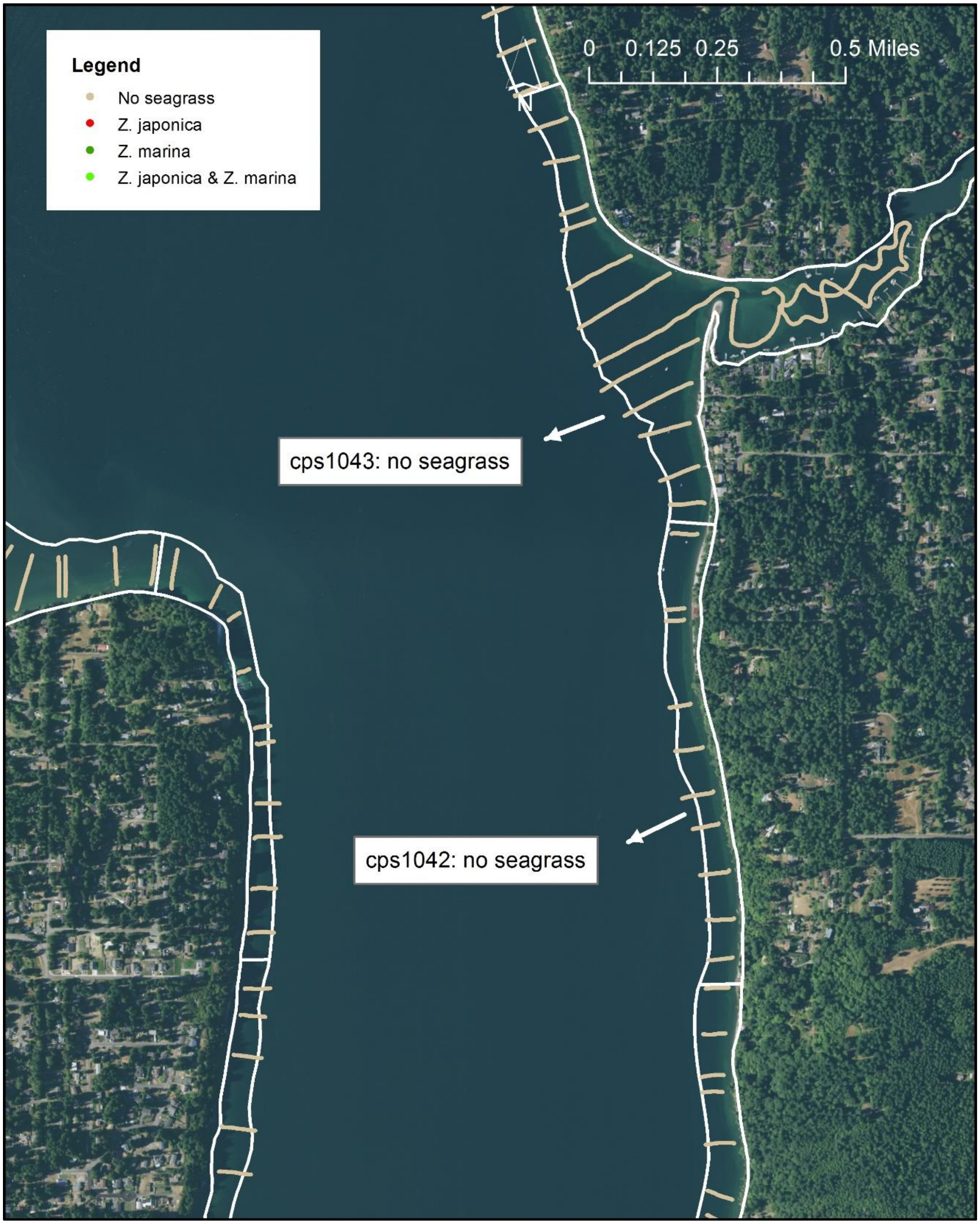


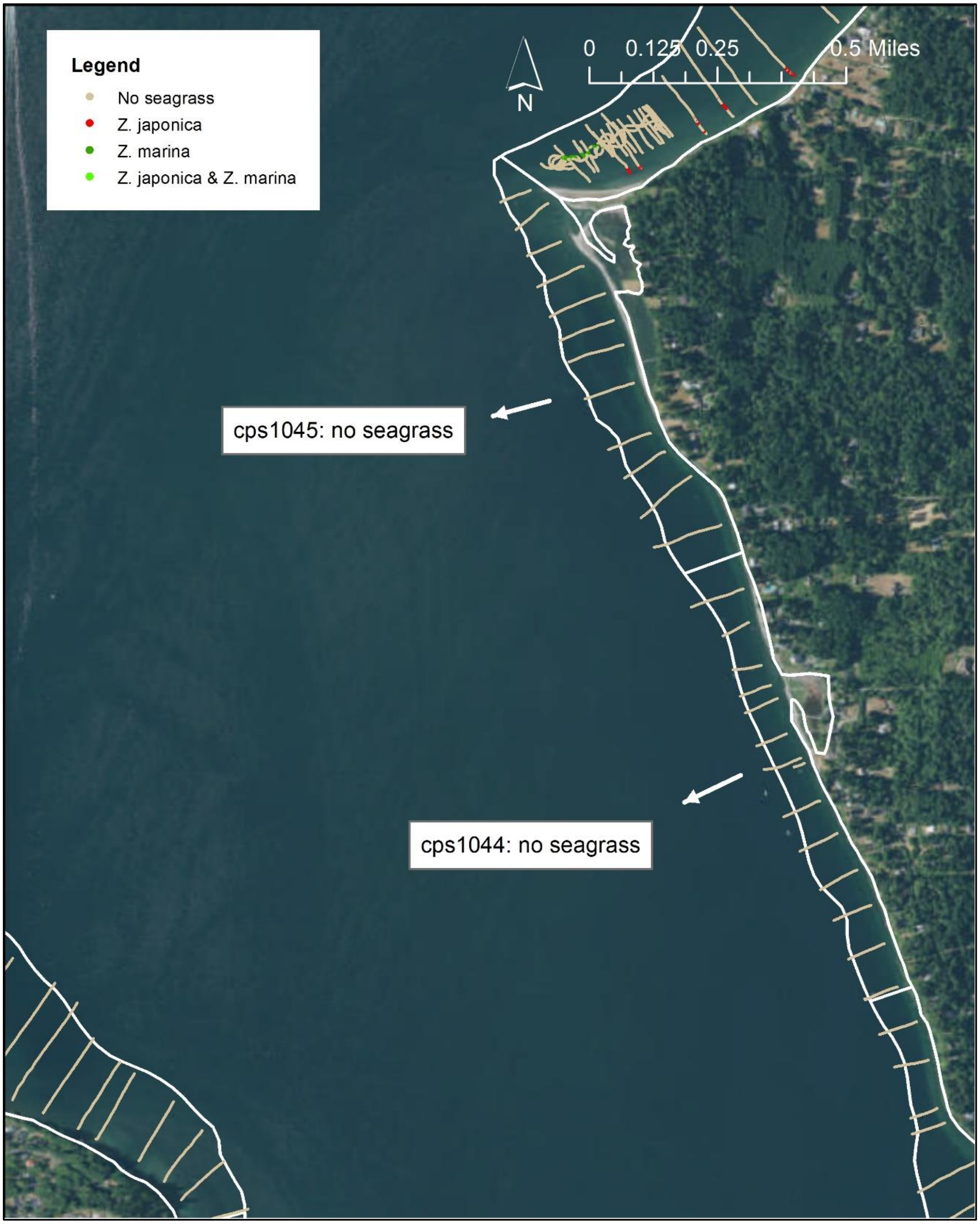
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1037: no seagrass
cps1036: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1039: no seagrass
cps1038: no seagrass

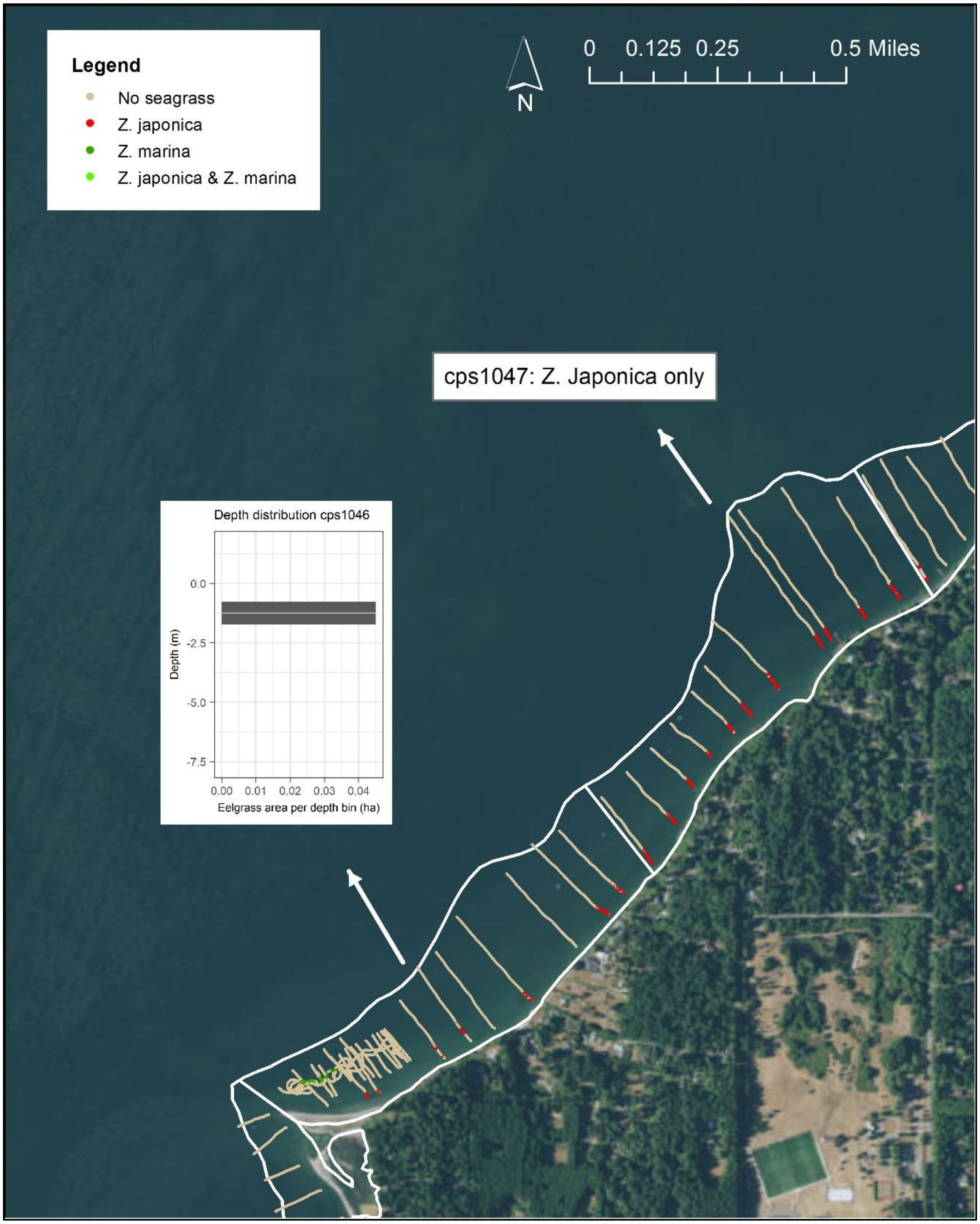


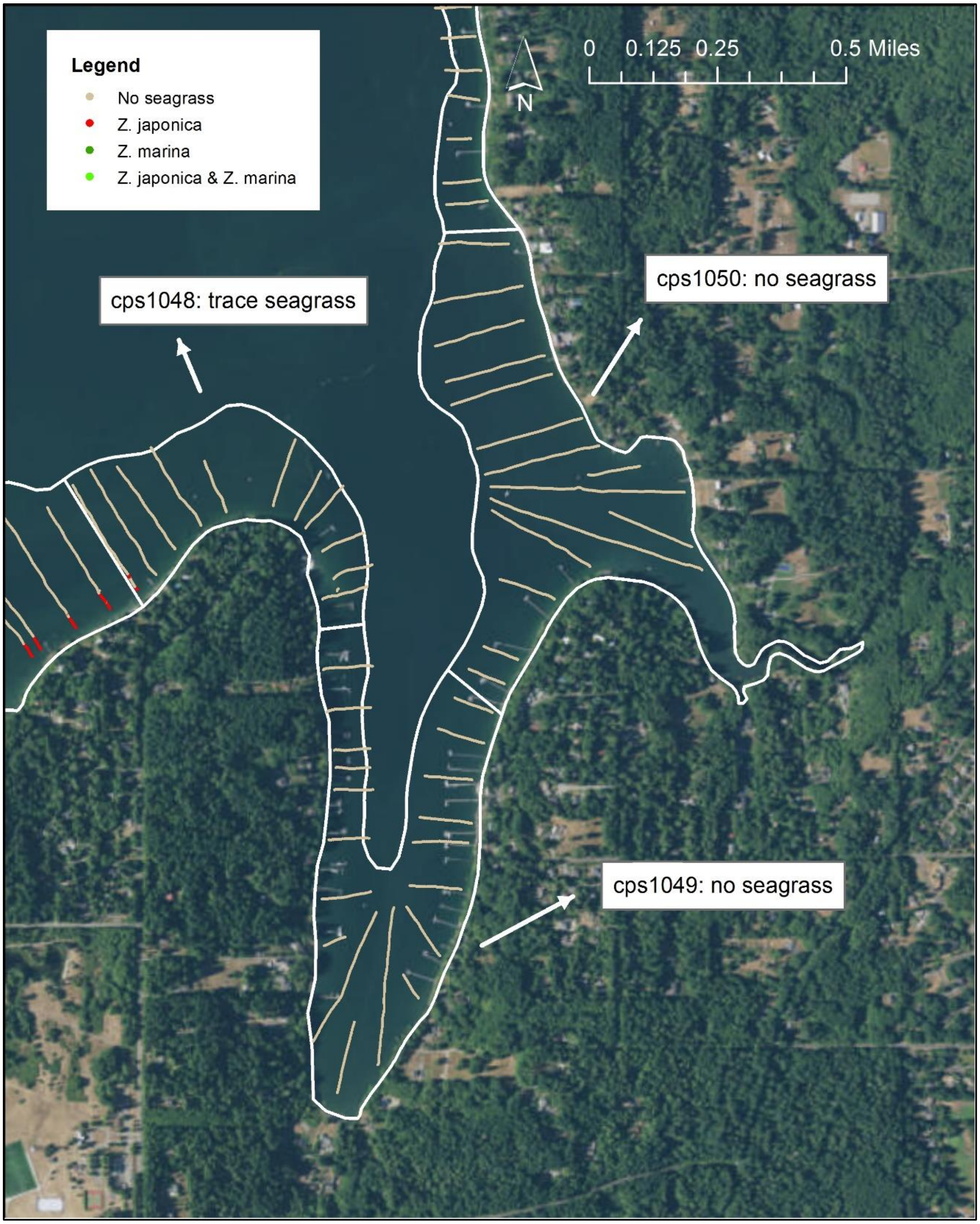
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1041: no seagrass
cps1040: no seagrass

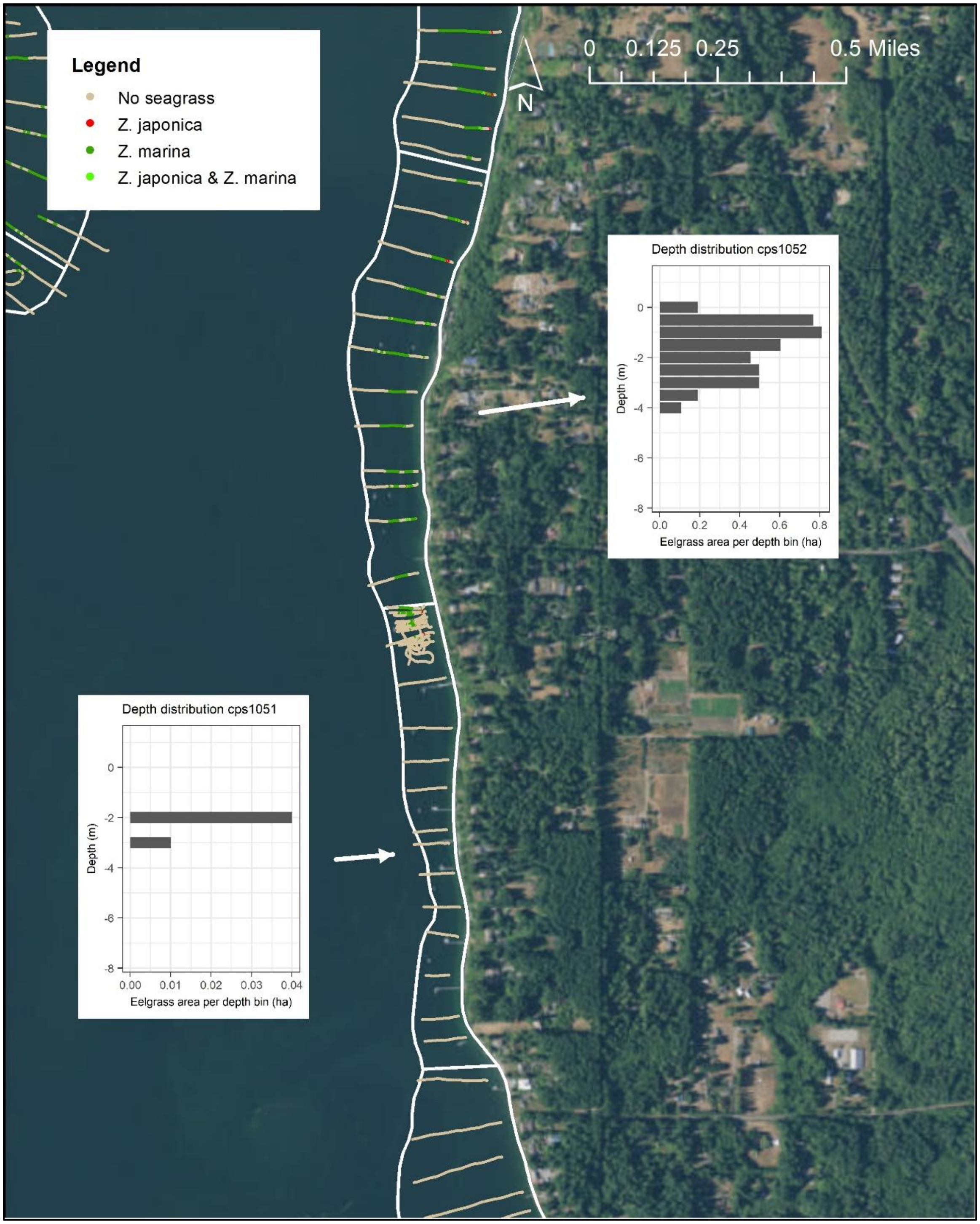

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
cps1043: no seagrass
cps1042: no seagrass



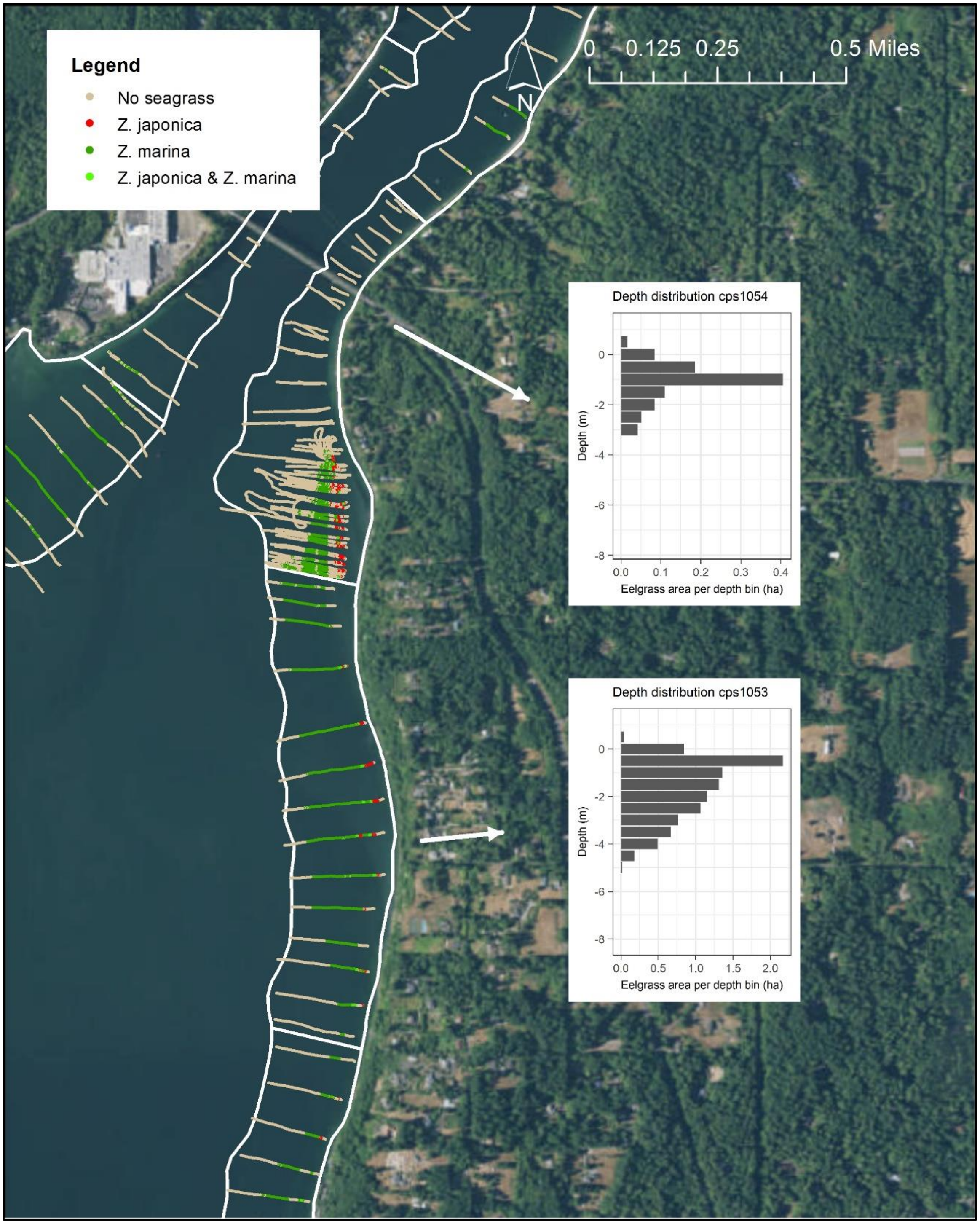
Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0
0.125
0.25
0.5 Miles
cps1045: no seagrass
cps1044: no seagrass


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1047: Z. Japonica only
Depth distribution cps1046
Depth (m)
0.0
-2.5
-5.0
-7.5
0.00 0.01 0.02 0.03 0.04
Eelgrass area per depth bin (ha)

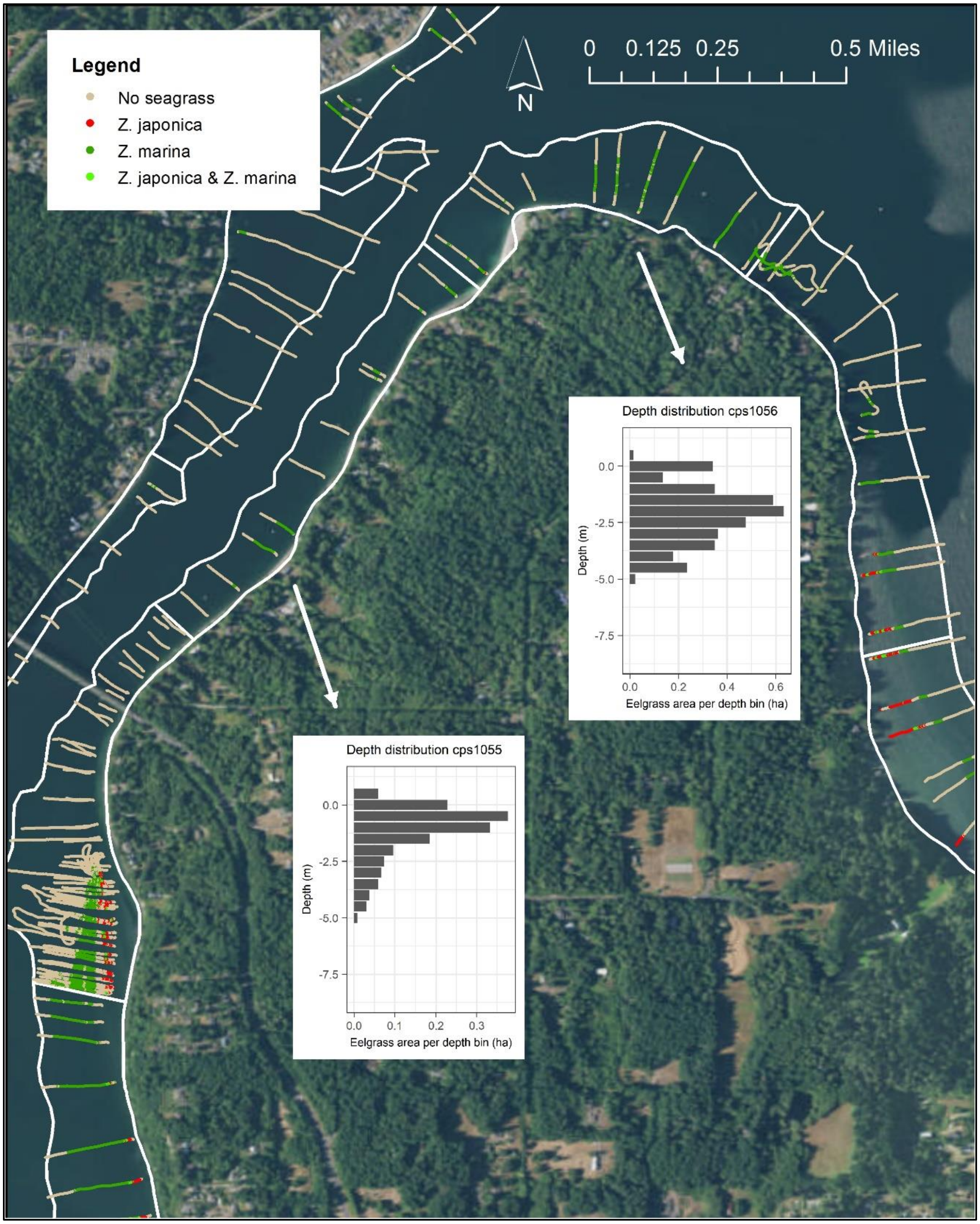

Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
cps1048: trace seagrass
cps1050: no seagrass
cps1049: no seagrass



Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1052
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1051
Depth (m)
Eelgrass area per depth bin (ha)



Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
0 0.125 0.25 0.5 Miles
N
Depth distribution cps1054
Depth (m)
Eelgrass area per depth bin (ha)
Depth distribution cps1053
Depth (m)
Eelgrass area per depth bin (ha)


Legend
No seagrass
Z. japonica
Z. marina
Z. japonica & Z. marina
N
0 0.125 0.25 0.5 Miles
Depth distribution cps1056
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.2 0.4 0.6
Eelgrass area per depth bin (ha)
Depth distribution cps1055
Depth (m)
0.0
-2.5
-5.0
-7.5
0.0 0.1 0.2 0.3
Eelgrass area per depth bin (ha)