An Aquaculture Opportunity Analysis for the Gulf of Alaska

March, 2025

Christopher Schillaci[1], Drew Resnick[2], Isaac Keohane[2], Jasmine Papas[2], Breanna Xiong[2], and James A. Morris, Jr.[1]

[1] Marine Spatial Ecology Division, National Centers for Coastal Ocean Science, National Ocean Service, NOAA, 101 Pivers Island Rd., Beaufort, North Carolina 28516

[2] CSS, Inc. under contract to the National Centers for Coastal Ocean Science, National Ocean Service, NOAA, 101 Pivers Island Rd., Beaufort, North Carolina 28516

Purpose

This report presents the methods and preliminary results of the Alaska Aquaculture Opportunity Area (AOA) spatial suitability analysis conducted by the National Oceanic and Atmospheric Administration (NOAA), National Centers for Coastal Ocean Science (NCCOS). The NCCOS spatial suitability analysis and underlying model detailed in this report are part of a multi-year planning process in which NOAA National Marine Fisheries Service (NOAA Fisheries) and the State of Alaska are working to identify AOAs in Alaska State waters to help sustainably advance shellfish and seaweed aquaculture (also referred to in Alaska as mariculture). This report summarizes the engagement, methods, and analysis used to develop the preliminary results (i.e., Draft AOA Options) presented here. This report and preliminary results are being provided for the purposes of sharing methods and results and collecting public input prior to the completion of the NCCOS spatial analysis, selection of final AOA Options, and the publication of a comprehensive peer-reviewed NOAA Technical Memorandum entitled "*An Aquaculture Atlas for the Gulf of Alaska.*"

The work presented here is the result of an AOA spatial suitability model (Model) developed by NCCOS with input from expert marine spatial scientists, marine ecologists, project coordinators, policy analysts, and subject matter experts (SMEs) at NCCOS, NOAA Fisheries, and the State of Alaska. Collectively, this team provided input during the model construction process, reviewed data layers, assigned weights, and informed the Model development and interpretation of results. These parties are referred herein as the Gulf of Alaska AOA Siting Team (Team).

About this Document

This report includes technical information to share preliminary results and methodology of the spatial analysis and will be made available for public comment prior to the completion of the NCCOS spatial study and publication of the final Atlas. The associated spatial analysis and input are intended to support the process mandated by Executive Order 13921 (E.O.), Promoting American Seafood Competitiveness and Economic Growth (May 7, 2020), to identify areas containing locations suitable for commercial aquaculture, herein referred to as an AOA. The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the authors, and do not necessarily reflect the views of NOAA or the Department of Commerce. The decision to identify one or more AOAs will only be made after completion of the National Environmental Policy Act (NEPA) process and consideration of the information presented in a Programmatic Environmental Impact Statement (PEIS). NOAA Fisheries and the state of Alaska will consider information received when finalizing the results of the spatial suitability analysis and final AOA Options as part of the AOA identification process. This report was developed for the specific purpose of sharing methods and preliminary results of the NCCOS spatial suitability analysis, and collecting public comment on locations that might be suitable for AOAs and includes limitations specific to that purpose. Caution should be exercised when using the report for other purposes (e.g., navigation, aquatic farm siting).

Executive Summary

NOAA has directives to preserve ocean sustainability and facilitate domestic aquaculture in the U.S. through the National Aquaculture Act of 1980, the NOAA Marine Aquaculture Policy and Executive Order (EO) 13921, "Promoting American Seafood Competitiveness and Economic Growth". The EO directed the Secretary of Commerce, in consultation with relevant federal agencies, to identify Aquaculture Opportunity Areas (AOAs) potentially suitable for commercial offshore aquaculture development. AOAs are identified based on the best available science and through public engagement, to facilitate aquaculture production; support environmental, economic, and social sustainability; and minimize unnecessary resource use conflicts. The identification of AOAs is a planning process. While identifying AOAs can help applicants with site selection and environmental analysis, it is not a preapproval for any location. Applicants for future aquaculture operations will still have to go through the full state and federal permitting and environmental review processes.

To support the E.O. requirement to identify AOAs, NCCOS collaborated with NOAA Fisheries and the State of Alaska to initiate a marine spatial planning study to identify draft AOA Options within state waters of Alaska. The final Alaska AOA study areas selected for spatial analysis were identified using a series of public engagement approaches including a Request for Information published in the Federal Register (88 FR 72046; October 19, 2023[1]) and one-on-one meetings with partners and local, state, federal and tribal governments. The draft AOA Options within each study area were identified based on public comment, bathymetric data, spatial connectedness to needed infrastructure, existing use considerations, oceanographic and meteorological conditions, cultural resources, natural resources, state and federal statutes, regulations, zoning, and policy, and political boundaries associated with state and federal water demarcations.

[1] https://www.federalregister.gov/documents/2023/10/19/2023-23084/identifying-aquaculture-opportunity-areas-in-alaska

Ten study areas were selected in Alaska state waters with minimal sea ice coverage, and centered around the population centers of: Juneau, Sitka, Petersburg, Wrangell, Craig, Ketchikan, Seward, Valdez, Cordova, and Kodiak Island. Geospatial analysis for identification of draft AOA Options was based on a categorical framework to ensure relevant, comprehensive data acquisition and characterization for spatial suitability modeling. An authoritative spatial data inventory was developed that included data layers relevant to administrative boundaries, national security (i.e., military), navigation and transportation, energy and industry infrastructure, commercial and recreational fishing, existing aquaculture locations, natural and cultural resources, and oceanography. There were a total of 78 data layers across these categories used in the analysis.

The spatial analysis detailed in this report was designed to meet certain planning goals and criteria within Alaska state waters. The NOAA Fisheries and Alaska AOA Interagency Working Group selected a planning goal to identify up to 4,000 acres of suitable subtidal draft AOA Options (i.e., up to 2,000 acres for seaweed, and up to 2,000 acres for shellfish or a combination) and up to 100 acres of suitable intertidal draft AOA Options within each study area. NOAA will not consider finfish aquaculture during identification of AOAs in Alaska because it is prohibited within state waters.

The modeling approach was designed to meet the industry and engineering requirements of depth (i.e., no more than 200 ft.) and distance from coastal population centers (i.e., no more than 25 nautical miles), and to ensure options are of sufficient size (50-2,000 acres) to support multiple aquaculture operations while accounting for buffers and potential reductions in size to accommodate vessel fairways or other potential conflicting uses.

The spatial analysis resulted in the selection of 97 Draft AOA Options across all study areas, which cover a total of 17,593 acres across all 10 study areas. Of the 97 Draft AOA Options, 76 were subtidal locations covering a total of 15,669 acres across all 10 study areas. The subtidal acreage varied, however, between each study area, ranging from a minimum of 2 subtidal draft AOA Options (covering 52 acres) in Seward to a maximum of 13 subtidal draft AOA Options (covering 2,193 acres and 2,336 acres) in Sitka and Kodiak, respectively. Similarly, the results showed variability in available intertidal areas. No intertidal options were identified in Cordova, Seward, and Valdez. This is largely due to the steep shoreline conditions and high tidal amplitude. In the remaining seven study areas, 21 intertidal draft AOA Options were identified spanning a total of 1,924 acres.

The draft AOA Options presented here were selected from hundreds of possibilities that emerged during the analysis. Within the ten study areas, different aquaculture opportunities may exist under different planning objectives or at different scales than considered here. Further, it is expected that important aspects of the complex cultural, socioeconomic, and environmental landscape of coastal Alaskan waters cannot be fully captured within a marine spatial planning (MSP) framework. The spatial modeling approach presented here represents a first step towards the identification of Alaska AOAs, which will be complemented by the NEPA process.

Table of Contents

Table of Tables

Table of Figures

Methods

A workflow for AOA spatial modeling was developed following the approach from Morris et al. 2021 and Riley et al. 2021 (Figure 1). The project requirements and study areas were identified through various engagement efforts. The goal of the analysis was to identify discrete locations within Alaska state waters that are the most suitable for the commercial cultivation of seaweed and shellfish or a combination of species. The steps within the workflow are described below (Figure 1)

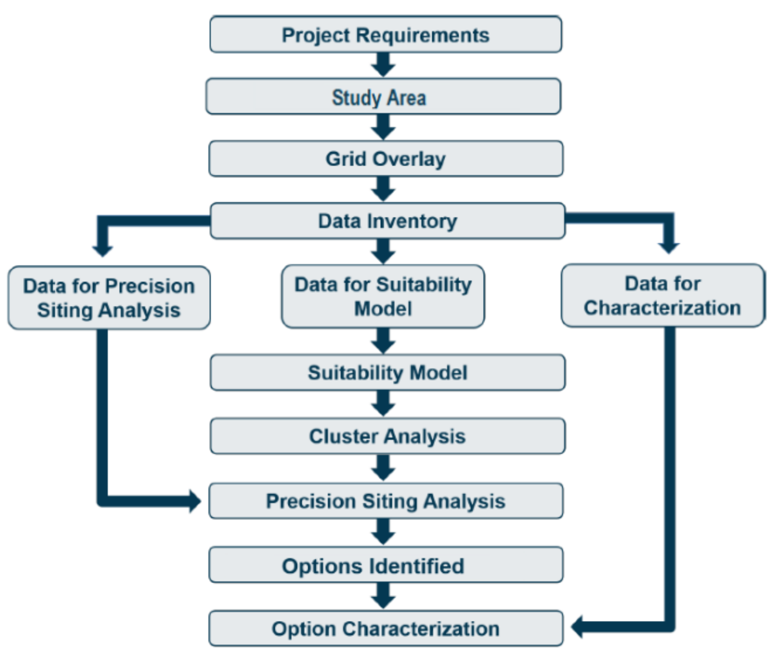


Figure 1. *Workflow for the NCCOS AOA spatial suitability analysis.*

Study Areas

To establish preliminary study areas for the spatial study, the Team identified project requirements based on input from industry and a review of existing permitted farm placement. This allowed NCCOS to exclude areas from modeling where the installation and operation of aquaculture farms may be significantly more challenging as a result of environmental or economic considerations, including:

a) Any area outside of 25-mile radius from a coastal populated place (defined as a coastal community with more than one thousand residents as reported by the U.S. Census Bureau 2010).[2]

b) Overlapping areas that did not regularly experience significant sea ice cover (based on the 10-year aggregate maximum sea ice reported by the U.S. National Ice Center[3]); and,

c) Areas outside of Alaska state jurisdictional waters.

Using these parameters, the Team identified sixteen preliminary study areas located along the coasts of Southeast, Southcentral, and Southwestern Alaska for a total of 6,948,728 acres centered around the communities of: Unalaska, Akutan, Kodiak, Anchor Point, Homer, Seward, Valdez, Cordova, Haines, Juneau, Sitka, Petersburg, Wrangell, Craig, Ketchikan, and Metlakatla that met the project requirements (Figure 2).

[2] https://www.census.gov/

[3] https://usicecenter.gov/

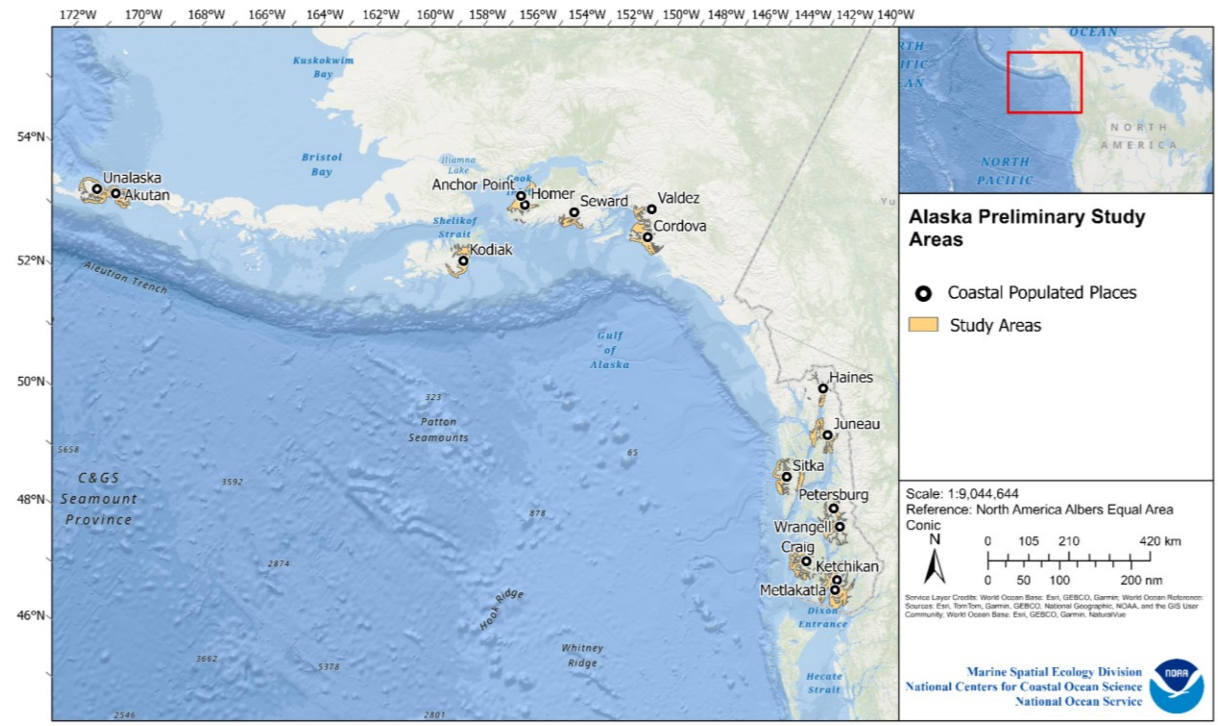


Figure 2. *Alaska AOA Preliminary Study Areas.*

Request for Information

NOAA Fisheries published a Request for Information (RFI) in the *Federal Register* (88 FR 72046; October 19, 2023)[4] seeking public input on the identification of study areas, data, and analyses relevant to identifying AOAs in Alaska state waters via a 60-day comment period. In addition to defining study AOA study areas in Alaska, NOAA Fisheries also sought feedback from Tribes, other partners, industry, and the public regarding the location and size of specific areas they wished to be included in (or excluded from) future AOA identification, along with other planning and siting considerations.

Following the publication of the RFI, NOAA Fisheries held three virtual listening sessions to share information and collect oral comments. NOAA Fisheries received 24 comments during the RFI (six oral comments, 17 electronic comments, and one letter). Comments included recommendations of specific areas to avoid or be considered for AOA identification, tribal resource considerations, fishing data to utilize in spatial modeling, and datasets representing protected species, among others. Electronic comments are available at: https://www.regulations.gov/document/NOAA-NMFS-2023-0113-0001/comment. Oral comments are available in listening session transcripts.

[4] https://www.federalregister.gov/documents/2023/10/19/2023-23084/identifying-aquaculture-opportunity-areas-in-alaska

Planning Goals

The Team established planning goals and criteria to further define the study structure. The specific planning goals for this study were to identify draft AOA Options with a minimum size of 50 acres and a maximum size of 2,000 acres which would be capable of supporting multiple aquaculture operations while allowing for optimal individual operation placement, buffers between operations and potential reductions in size to accommodate vessel traffic or other potential conflicting uses. Within each study area, the planning goals were to identify up to 4,000 acres of suitable subtidal draft AOA Options for seaweed and shellfish submerged culture, and 100 acres of suitable intertidal draft AOA Options for shellfish on bottom culture. Additional project requirements based on water depth were also established based on input from industry and a review of existing permitted farm placement. In addition, the original study area boundary of 25 miles linear distance from population centers was further refined to a 25 nautical mile transit distance boundary (Table 1). Areas that fell outside of the established water depth and distance from population center planning goals were constrained and excluded from spatial modeling.

Table 1. *Criteria for selecting final AOA study areas.*

Draft AOA Option Criteria	Description
Draft AOA option size range	50- 2,000 acres
Acres per study area to identify	Subtidal- up to 4,000 ac Intertidal- 100 ac
Depth range	Subtidal- 4.5 m to 60 m (15ft to ~200 ft) Intertidal- MHHW to 1 m MLLW
Location	State waters ≤ 25nm transit distance from the study area population center

Selection of Final Study Areas

Based on feedback received through the RFI and best available information, the Team finalized 10 study areas (Figure 3) in March 2024 for the Alaska AOA spatial model.

The final Alaska study areas included six areas located in Southeast Alaska, three in Southcentral, and one expanded area in Southwest Alaska (Figure 3). The study areas consisted of Alaska state waters within a 25 nautical mile radius of the communities of: Juneau, Sitka, Petersburg, Wrangell, Craig, Ketchikan, Seward, Valdez, and Cordova. In response to public and agency comments, the Kodiak Island study area was expanded to include areas in proximity to Old Harbor and Larsen Bay, and the communities of Haines, Homer, Anchor Point, Unalaska, and Akutan were not selected for inclusion in the spatial study. Annette Island and the surrounding tribal waters are the only Indian Reservation in all of Alaska. Tribal leadership in Metlakatla requested that this area not be included in the AOA study areas, but wished to pursue additional spatial analysis for aquaculture and other activities with NOAA outside of this process.

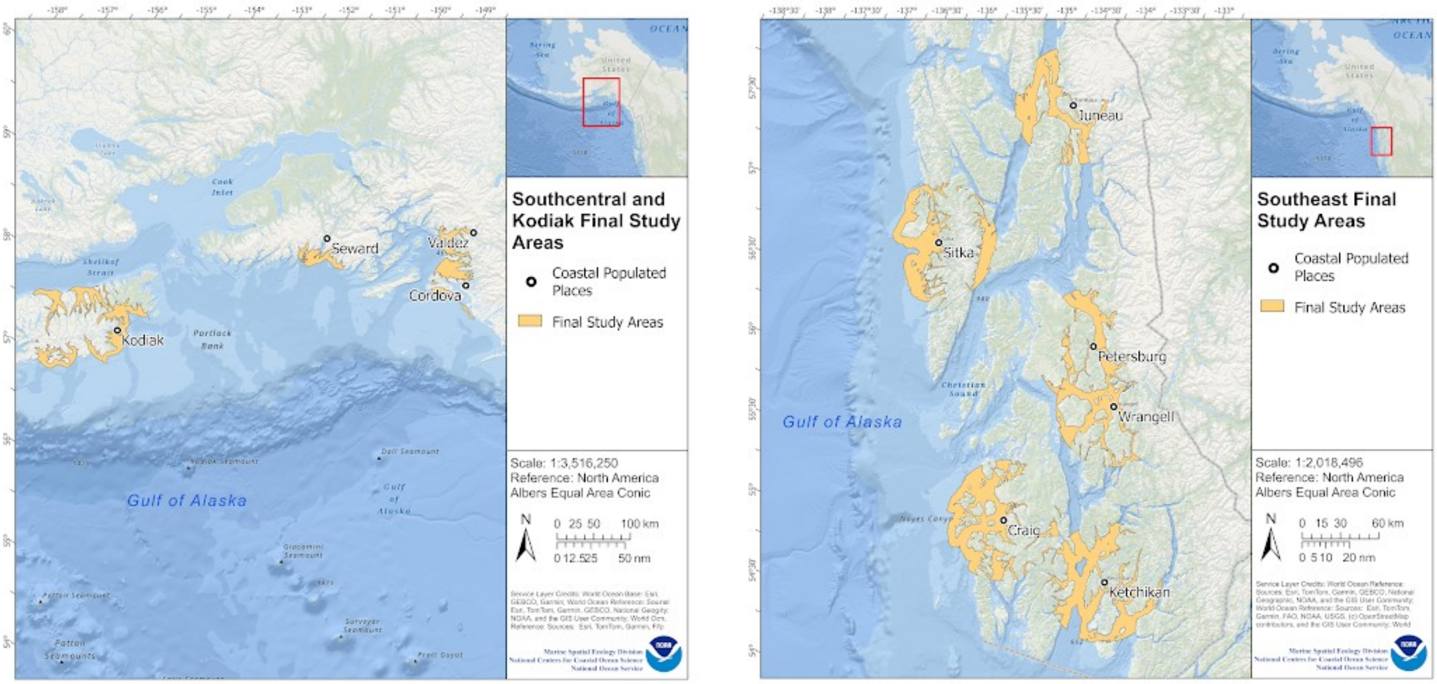


Figure 3. *Final Alaska AOA Study Areas in (a) the Southcentral and Kodiak regions and (b) the Southeast region.*

Grid Overlay

After applying the planning goal requirements to the select study areas, a 5-acre hexagonal grid was overlaid to the remaining portions of the study areas in ArcGIS. A hexagonal grid was used because it fits organic shapes and curves (e.g., coastline, pipelines, submarine cables, etc.) better than square grids. This shape also provides advantages for statistical analysis as all neighboring cells share a side and the distance from the center is the same distance to all neighboring cells (Sousa et al. 2006; Birch et al. 2007; Tsatcha et al. 2014; Domisch et al. 2019).

Data Categorization

In the AOA spatial modeling process, the identification of potential AOA Options requires an understanding of the relationship between different elements of the environment and ocean uses, as well as the practical requirements for the development of aquaculture in Alaska state waters. Spatial suitability modeling is a type of Multi-Criteria Decision Analysis which provides the ability to calculate a relative suitability score for each grid cell in an area. Data categorization was based on schema provided in Lightsom et al. 2015 because the intent of the categorical structure is for ocean planning. The structure intends to bring transparency and a consistent framework for organizing complex and dynamic ocean systems (Lightsom et al. 2015). The categorical framework included herein ensures all necessary data needed for AOA site suitability analysis, a specific type of ocean planning, were included.

Data Acquisition

Acquisition of spatial data is a key factor in model success because it is the base for further calculations and analysis (Molina et al. 2013). An initial literature review was completed to determine the broad suite of data and categories needed to properly support this analysis. A comprehensive, authoritative spatial data inventory was developed including data layers relevant to administrative boundaries, national security (i.e., military), navigation and transportation, energy and industry infrastructure, commercial and recreational fishing, natural and cultural resources, and oceanography (See Appendix A). Data holdings were developed through engagement with U.S. Federal and state agencies and tribal governments and a diverse array of other ocean users. Many datasets were leveraged through the MarineCadastre[5] and Alaska Ocean Observing System[6]. NOAA used a categorical framework to ensure relevant data were comprehensively acquired and considered for modeling. This included layers relevant to the following categories: national security, natural resources, cultural resources, industry, and fisheries.

In addition, NOAA Fisheries, in coordination with NCCOS and the State of Alaska held two AOA Spatial Planning Workshops. The workshops presented an opportunity for attendees to learn more about the AOA spatial planning approach and discuss available spatial data within Alaska AOA study areas, document data gaps, and help identify points of contact for the identification of additional spatial data. The first workshop took place on February 26, 2024 in Anchorage, and the second on March 26 and 27, 2024, in Juneau. The Juneau workshop included a Tribal Panel discussion with representatives from several Southeast Alaska Native Organizations. Over 130 individuals attended the workshops. Participants across both events included Alaska Native community members and Tribal government representatives, fishermen, aquaculture industry representatives, environmental organizations, scientists, subject matter experts, and State and Federal agency personnel. A workshop summary report is available here[7].

NOAA Fisheries and NCCOS also held over 100 engagement meetings to seek feedback to develop data sets, support data processing methods, and refine the spatial modeling methodology to inform the identification of draft AOA Options for further public comment. These included in-person and virtual meetings with Federal, Tribal, and State government agencies, as well as in-person and virtual meetings with various coastal and ocean user groups throughout the Alaska study areas.

Data Processing and Buffers

Many datasets required processing prior to use in the spatial analysis. For example, long term aerial herring spawning survey data collected by the Alaska Department of Fish and Game were available in a number of study areas. It was necessary to process these data in a manner that would provide an understanding and scoring approach of both spawning occurrence and historic frequency at the grid cell level. Summary methods are provided for all data that required processing in the Appendix A; many data were received in a ready-to-use format and processing notes can be found in metadata provided by the data originator. Buffer distances were applied when required by governance, policy, and regulations. In cases where an established setback requirement was not available from an authoritative source, conservative professional judgment was used when assigning buffer distances.

---

[5] https://hub.marinecadastre.gov/

[6] https://aoos.org/

[7] https://www.fisheries.noaa.gov/s3//2024-08/Alaska-AOA-Spatial-Planning-Workshops-Report.pdf

Suitability Analysis

A gridded relative suitability analysis, commonly used in a Multi-Criteria Decision Analysis, was performed independently for each study area to identify the 5-acre grid cells with the highest suitability for aquaculture development in the study areas (Longdill et al. 2008; Radiarta et al. 2008; Gimpel et al. 2015). Spatial data layers included in the suitability analysis identify space-use conflicts and environmental constraints such as active national security areas, maritime navigation, ocean industries, cultural resources, and natural resources. We utilized a submodel structure to bin each spatial data layer into categories including national security, natural and cultural resources, industry, navigation, and transportation, and aquaculture and fishing (Figure 4). This model structure ensures that each submodel is given equal weight in the final suitability model regardless of how many data layers are present in each submodel. Further, distribution of scores varies among the suitability submodels; for example, in one submodel a score of 0.5 could be classified as “High,” while in another submodel or region a score of 0.5 could be “Low” because the scores are relative. Thus, suitability scores among the different study areas and different submodels should not be compared, as the score is unique to each study area and submodel.

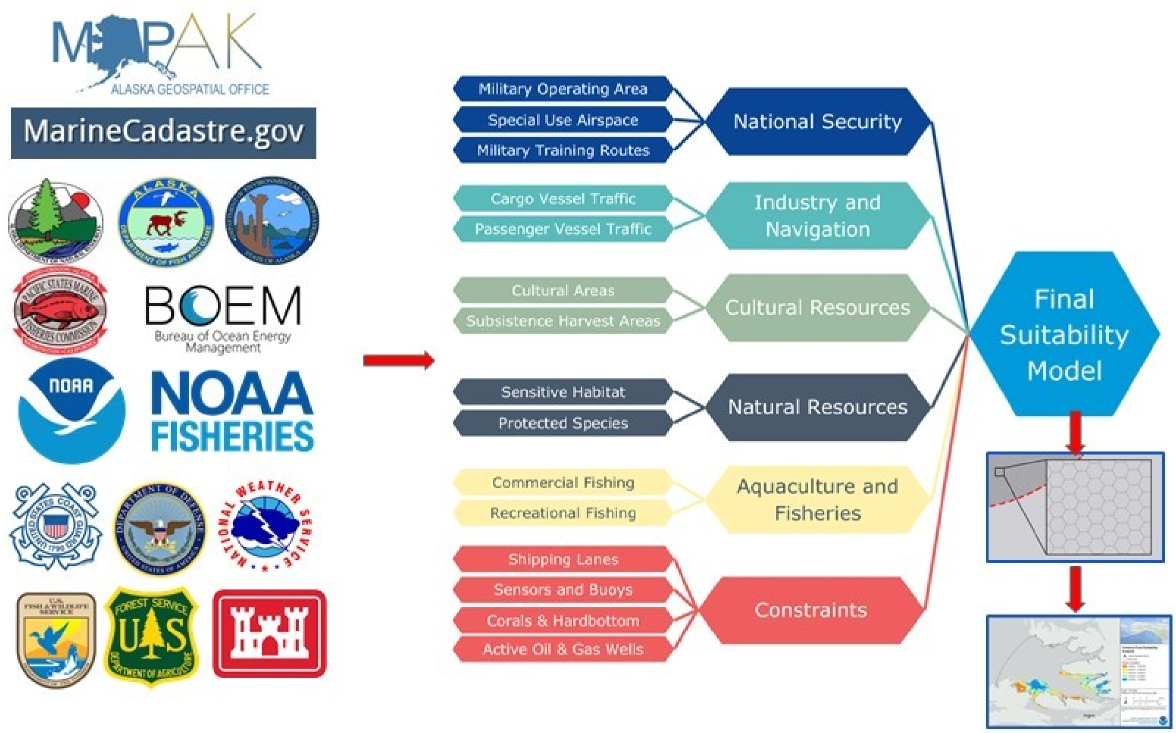


Figure 4. *Example of a suitability model utilizing a submodel structure where data layers are grouped based on ocean use topics. Geospatial data were provided by numerous State and Federal agencies and tribal entities, including but not limited to, those above to be included in the suitability analysis. A final suitability score is calculated for each grid within the Call Areas resulting in a final heat map displaying areas of relatively low and high suitability for aquaculture development.*

Data Scoring

Each data layer was scored on a 0 to 1 scale, with scores approaching 0 representing low suitability and 1 representing high suitability for aquaculture relative to the other grid cells in the study area. Data layers with no suitable aquaculture development due to use conflict or practical considerations (e.g., law, regulation, policy, or zoning code) were considered “constraints” and given a score of 0. Any grid cell that contained a data layer with a 0 score (i.e., constraints data layer) was deemed unsuitable for aquaculture, and not considered further in the analysis.

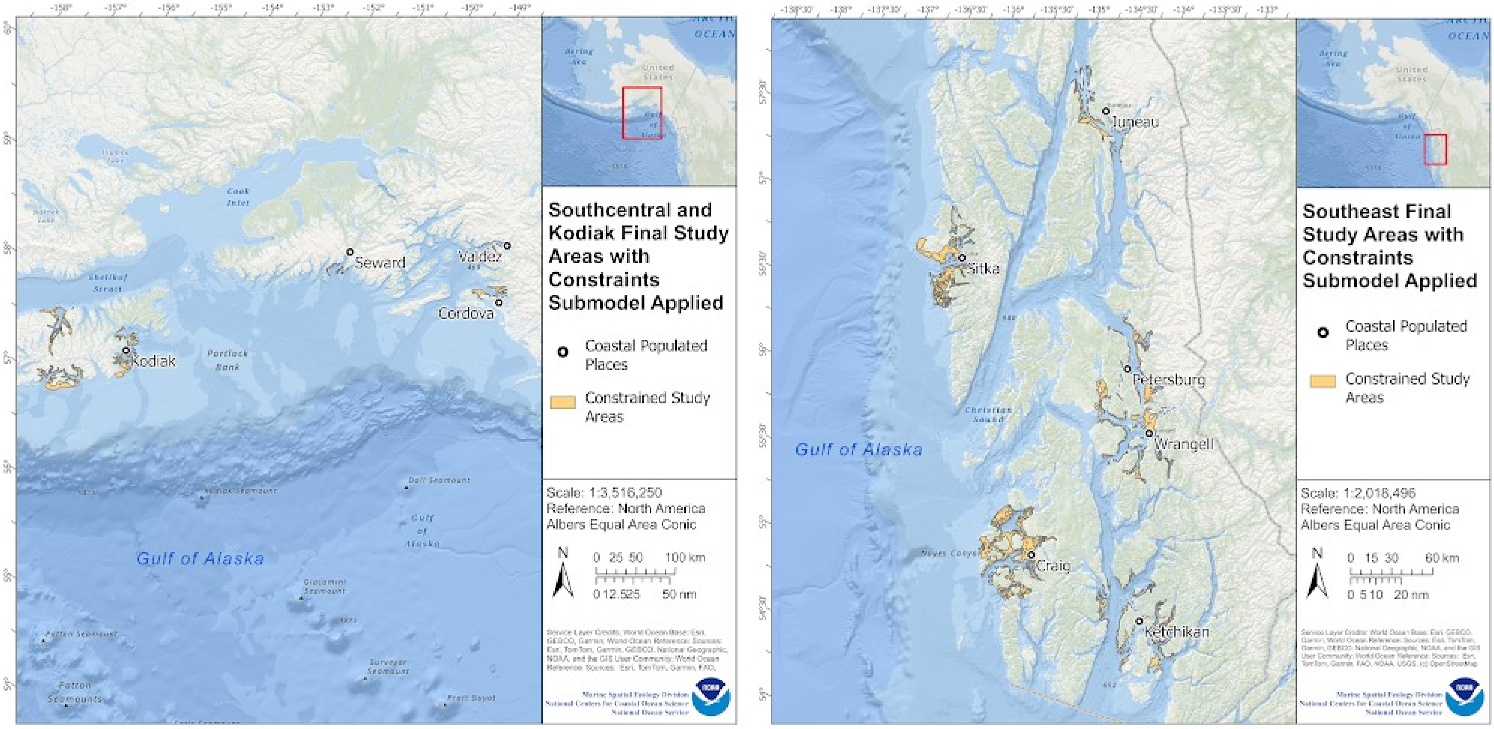


Figure 5. *Final Alaska AOA Study Areas with constraints applied.*

Next, a final suitability score was calculated for each submodel by taking the geometric mean of all scores for each data layer in the submodel. The geometric mean of the four submodels was then used to calculate a final overall suitability score. The geometric mean was chosen because it grants equal importance to each variable (Bovee 1986; Longdill et al. 2008; Silva et al. 2011; Muñoz-Mas et al. 2012). Furthermore, all data layers and submodels had equal weight within the suitability model. Final suitability scores are presented within maps grouped by quantiles of the final scores. Standardized colors were used to depict categories, with orange representing the lowest suitability, yellow moderate suitability and blue the highest suitability and coinciding with each proportion of quantile values.

Local Index of Spatial Association

A Local Index of Spatial Association (LISA) analysis (hereafter ‘cluster analysis’), which identifies statistically significant clusters and outliers of the final relative suitability modeling results was performed for each study area and for both intertidal and subtidal scenarios. The cluster analysis identified clusters that were significantly different from other cells at a 95% confidence interval ($p < 0.05$). The cluster analysis identified 3,341,873 acres of high-high clusters, which are groups of cells with high values that are statistically significant from other cells.

Precision Siting Model

A precision siting model adapted from Riley et al. 2021 was developed using custom rules and an adapted version of the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to identify the most suitable draft AOA Options in each study area and for both intertidal and subtidal scenarios.

The first step in the precision siting model evaluated the final high-high cluster output (i.e., most suitable areas from the suitability model) derived from the LISA cluster analysis; after refining to just those sites greater than 50 acres in size (i.e., the minimum AOA size requirement). Industry feedback identified a preference toward areas with limited seafloor slope, shallower operationally appropriate depths, and a shorter distance to port, due to logistical challenges and costs associated with deploying mooring systems in high seafloor relief areas and at greater depths, and potential economic impacts related to travel distance. In addition, industry feedback suggested a preference for sites with moderate to low wind and wave exposure to support engineering thresholds and access across weather conditions. Additional feedback from the U.S. Coast Guard, fisheries managers, and the fishing industry also supported an approach where siting proximate to shore would support minimizing vessel traffic and some fishing activity due to a tendency for both sectors to avoid certain shoreline features which can present hazards to navigation and to fishing gear.

We used a structure that first produced normalized scores between 0 and 1 from several metrics identified by industry and managers characterizing a location (e.g., travel distance to coastal population center, distance to shore, depth, and slope), with values closer to 1 representing better conditions for draft AOA Options. As constructed for this analysis, this normalization procedure had the effect of prioritizing areas with shorter distances to coastal population centers, shoreline with shallower depths, and a flatter seafloor.

Previous work conducted in Morris et al. 2021 and Riley et al. 2021 sought to identify rectangular options for ease in computation, for boundary establishment, and to maintain position to the cardinal directions. This approach is ideal in open ocean areas where bathymetry and exposure are not as heavily influenced by the coastline as in coastal waters. In our study areas, the coastal geology often includes deep channels and bays with narrow shoreline-adjacent depth contours suitable for coastal aquaculture operations (less than 200 feet in the case of this study). In addition, proximity to shoreline features were often correlated with reduced wave and wind exposure within study areas. As a result, identifying options with boundaries that follow the coastline and bathymetric contours was required to stay within planning goals and focus on areas with operationally ideal conditions. This was also critical to meet the planning goals of identifying AOA Options suitable for multiple operations. Ultimately, individual operation siting may allow for sites with simplified geometry within our identified larger irregularly shaped options.

Within-Cluster Precision Siting Model

All grid cells within the remaining (greater than 50 acres) high-high clusters were ranked using the within-cluster model, identifying the highest suitable groupings of cells within each cluster using the TOPSIS ranking described above. Slope, distance to population center, distance to shore, and depth data were extracted for each grid cell and normalized to a 0 to 1 range, with 0 being less suitable for aquaculture and 1 being more suitable for aquaculture. This is a similar approach to scoring the data as used in the suitability model; however, it is important to note that the rescaling is performed separately within each individual cluster for the within-cluster model. Selected data sets and data rescaling functions are presented in Table 2. Once the cells for each cluster were ranked internally, the optimal locations within each cluster were chosen to be compared against each other using an Among-Cluster model. For larger clusters (greater than 500 acres) either the highest ranking 500 acres from the within-cluster TOPSIS or the highest-ranking 10% of the cluster area (whichever is larger) was kept and dissolved into new continuous polygon regions. For clusters less than 500 acres in area, the entire cluster is passed to the among-cluster model to be compared against other site potential locations.

Table 2. *Data layers used in the precision siting model and rescale function.*

Data Layer	Rescale Function
Seafloor Relief (Slope)	Linear
Depth	Linear
Travel distance to coastal population center	Linear
Distance to shore	Linear

Among-Cluster Precision Siting Model

The candidate polygon locations returned from the within-cluster siting model were then assessed using the among-cluster model, which ranked these areas from different parts of the study area against each other. Before this extraction and ranking was run, a "simplify geometry[8]" tool was run using R terra to slightly simplify the areas. The TOPSIS ranking metric was then produced for each of these potential AOA Options, run separately for each study, which informed the final step of this process: manual inspection and optimal site selection.

Final Draft Option Selection

Highest ranking potential Draft AOA Options within each study area were selected based on a combination of precision siting scores and manual inspection of geometry. High scoring potential options with shapes that were not compatible with the planning goal (e.g., clusters primarily consisting of a width of 1-3 adjacent grid cells or other irregular geometry) of identifying options that can support multiple aquaculture operations were removed. The remaining high scoring potential draft AOA options within each study area were subjected to review by the Team to address possible permitting, leasing, navigation, or other constraints not included within the suitability model structure (e.g., changes in upland ownership and/or lease status since model initiation, major navigation conflicts, significant natural or cultural resource conflicts, etc.). Options with identified constraints were removed or modified (e.g., conflicted portions removed) to address constraints. The remaining top-ranking options were identified as the final draft AOA Options within each study area. Where necessary, boundaries of the final draft AOA Options were further simplified to reduce the number of corners and/or adjusted to address deviations in shoreline and bathymetric boundaries and the grid structure (e.g., the landward edges of grids cells with portions that extended into upland areas were clipped to the shoreline).

[8] https://rdrr.io/cran/terra/man/simplify.html

Results

The spatial analysis resulted in the selection of 97 Draft AOA Options across all study areas, which cover a total of 17,593 acres across all 10 study areas. Of the 97 Draft AOA Options, 76 were subtidal locations covering a total of 15,669 acres across all 10 study areas. The subtidal acreage varied, however, between each study area, ranging from a minimum of 2 subtidal draft AOA Options (covering 52 acres) in Seward to a maximum of 13 subtidal draft AOA Options (covering 2,193 acres and 2,336) in Sitka and Kodiak, respectively. Similarly, the results showed variability in available intertidal areas. No intertidal options were identified in Cordova, Seward, and Valdez. This is largely due to the steep shoreline conditions and high tidal amplitude. In the remaining seven study areas, 21 intertidal draft AOA Options were identified spanning a total of 1,924 acres across all study areas (Table 3).

Suitability model results and selected draft AOA Options are presented in Figures 6- 24. Draft AOA Option characterization is presented in Tables 4-12.

It is important to note that these results are reflective of the planning objective to identify draft AOA Options. Within the study areas, different aquaculture opportunities may exist under different planning objectives or at different scales than considered here. Further, each study area is independent within the planning process and scores and statistics can only be compared within each distinct study area. The scores and statistics of the resulting draft AOA Options cannot be compared among different study areas. Discrete variables given a score of 0.5 or less in the site suitability analysis should be considered conservative and further discussions with agencies charged with management of those resources could result in score adjustment, likely in the direction of higher compatibility.

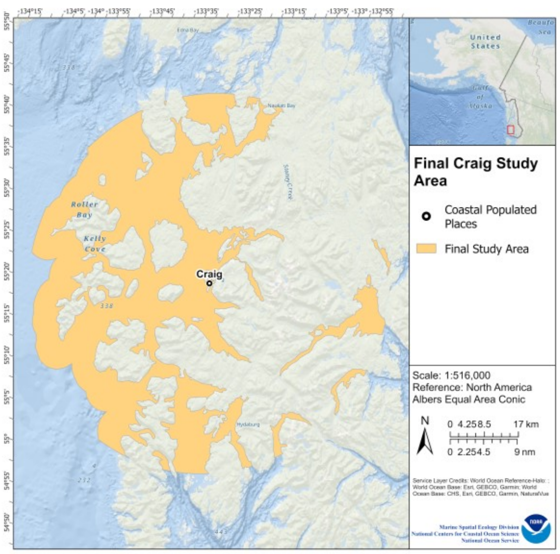
Table 3. *Study area total coverage.*

Study Area	# of subtidal draft AOA options	Total subtidal acreage	# of intertidal draft AOA options	Total intertidal acreage
Cordova	6	767.01	0	0
Craig	11	2024.44	3	241.72
Juneau	7	1509.89	4	285.81
Ketchikan	12	2532.48	3	282.50
Kodiak	13	2336.03	5	264.27
Seward	2	511.93	0	0
Sitka	13	2193.30	3	590.63
Valdez	4	537.03	0	0
Wrangell-Petersburg	8	3257.73	3	258.69

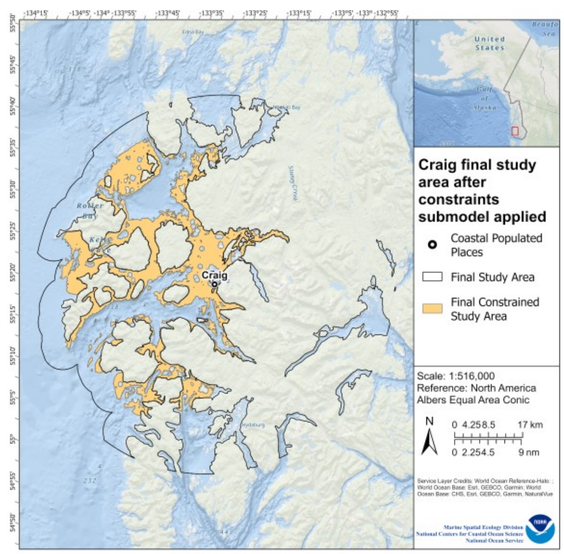
Southeast Alaska

Craig

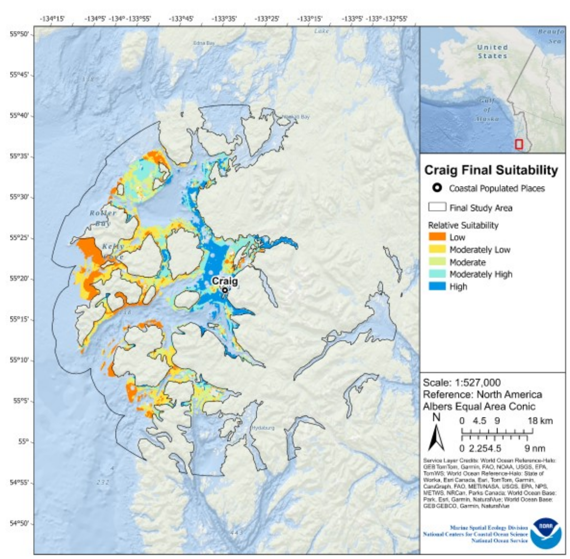
A total of eleven subtidal Draft AOA Options and three intertidal Draft Options were selected for the Craig study area. The Draft AOA Options spanned a total of 2265 acres. The subtidal clusters totaled 2024 acres with individual options ranging between 72 acres to 436 acres. The intertidal clusters totaled 241acres with individual options ranging between 75 acres to 83 acres.



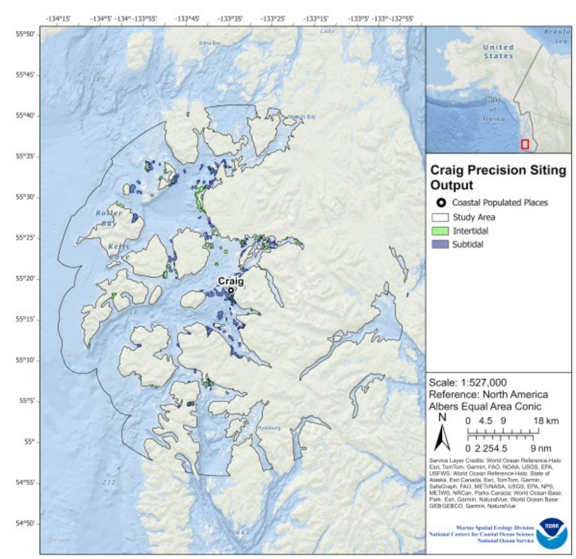
A.



B.

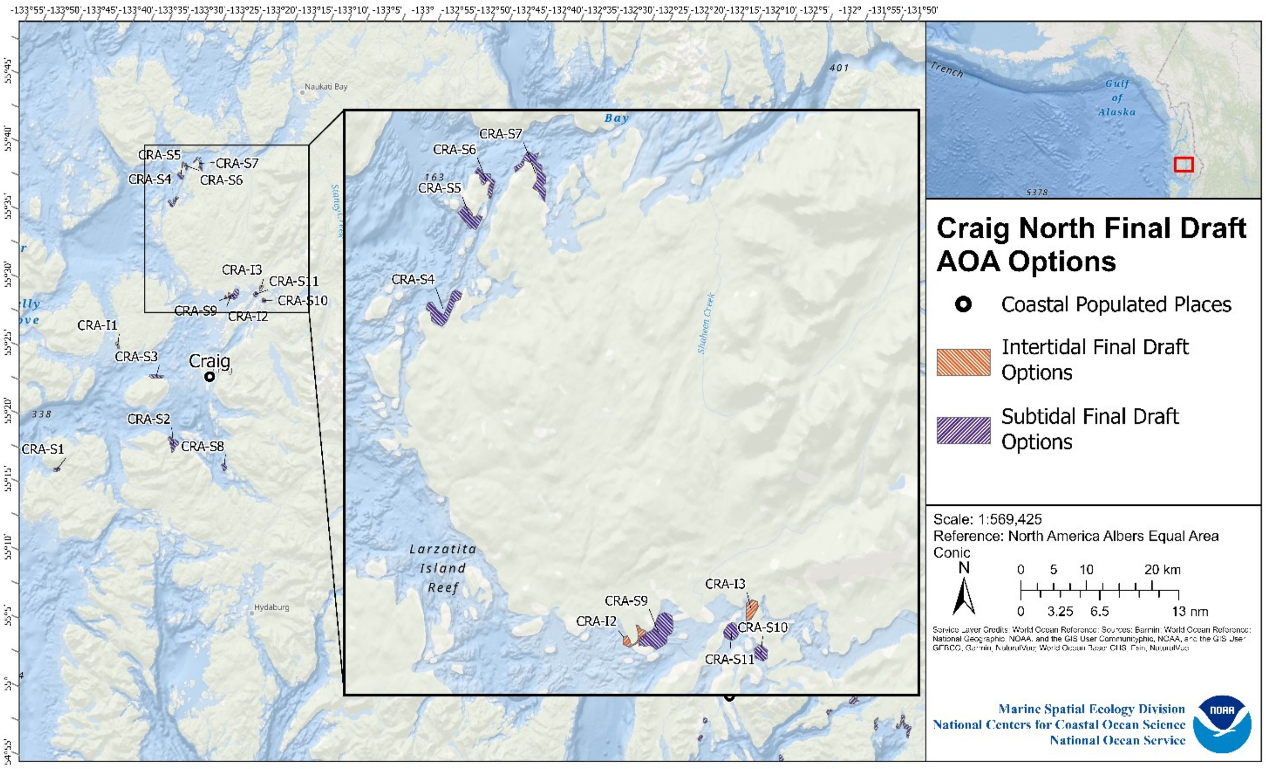


C.



D.

Figure 6. *Modeling process for the Craig study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*



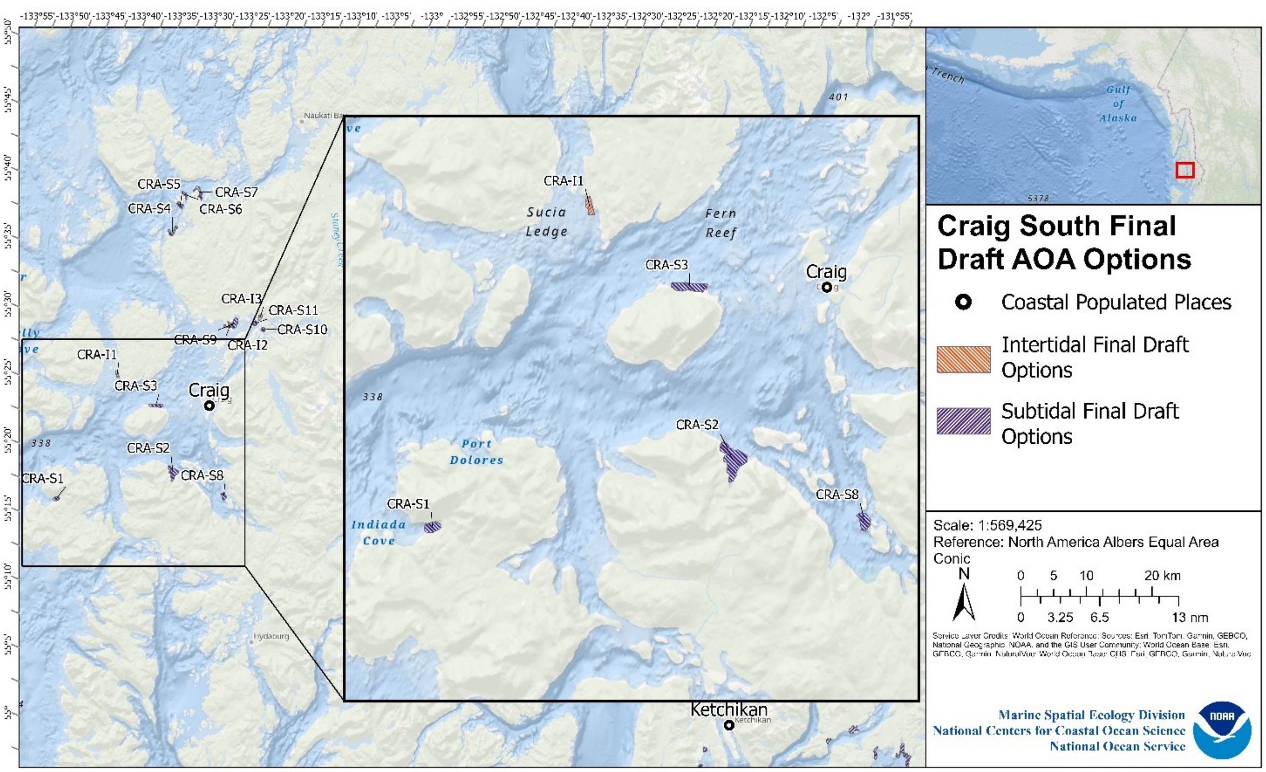


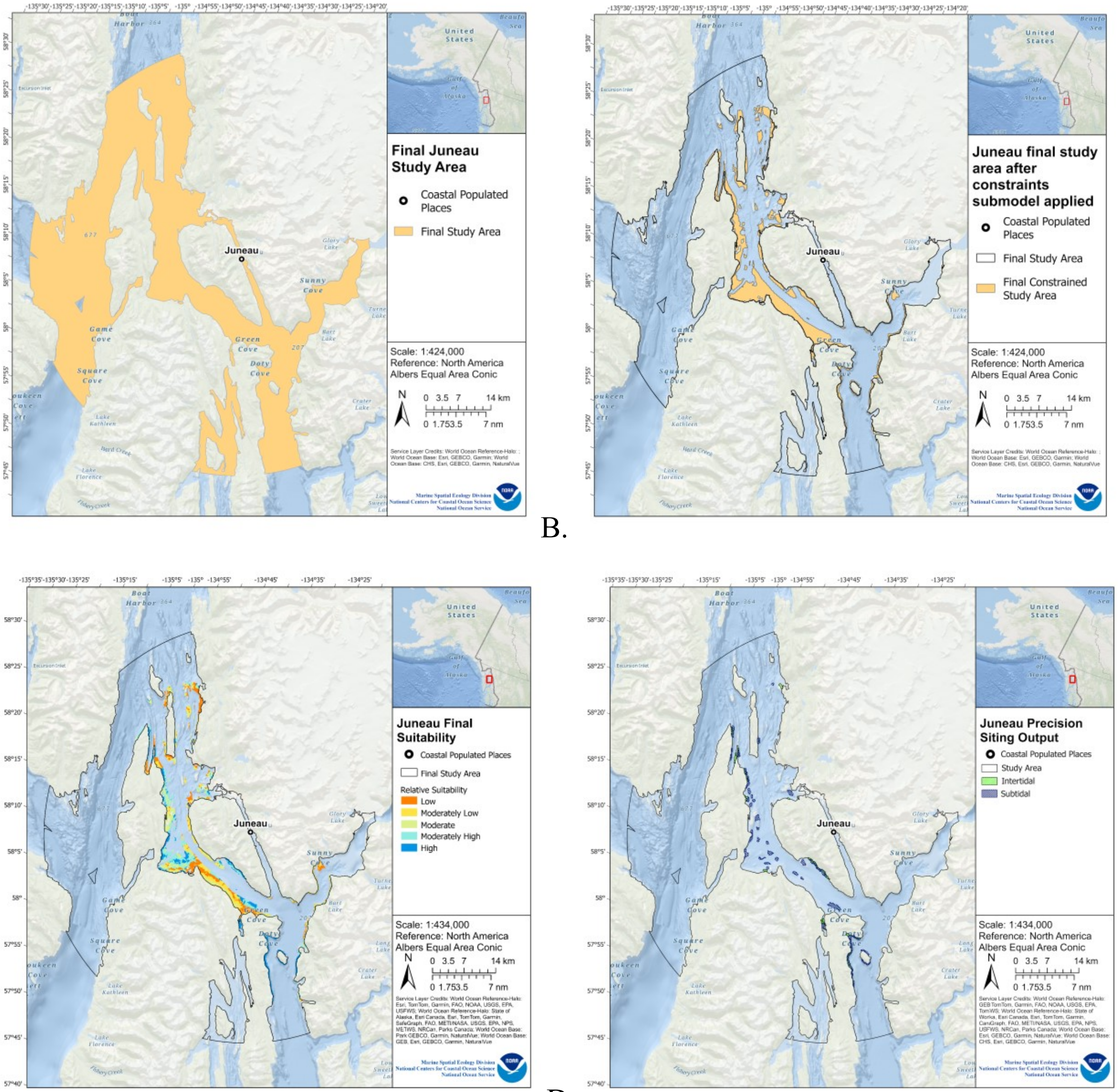
Figure 7. *Final Draft AOA Options for the Craig study area, top map: Northern extent, bottom map: Southern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

Table 4. *Final Draft AOA Options characterization parameters for the Craig study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (a)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
CRA-S1	55.2848, -133.411	115.31	0.58, 26.09, 15.69	4.6	32956.46
CRA-S2	55.3759, -133.168	436.13	-23.34, 83.44, 31.86	7.21	11636.85
CRA-S3	55.4495, -133.271	223.23	-1.86, 32.57, 14.16	3.9	7499.11
CRA-S4	55.6715, -133.399	198.17	-14.02, 50.1, 21.9	7.6	29100.63
CRA-S5	55.7075, -133.407	130.2	1.15, 45.54, 21.78	7.24	32767.93
CRA-S6	55.7228, -133.406	89.97	-6.11, 59.21, 22.91	11.68	34531.46
CRA-S7	55.7328, -133.376	200.83	-29.05, 43.76, 11.69	7.91	36827.41
CRA-S8	55.3726, -133.028	136.67	18.72, 81.99, 39.79	4.46	14751.52
CRA-S9	55.5897, -133.169	326.13	-1.55, 24.81, 11.24	1.91	13343.48
CRA-S10	55.5972, -133.095	72.77	-2.83, 14.86, 6.1	2.05	14836.99
CRA-S11	55.6006, -133.121	95.03	-5.4, 12.15, 7.64	1.96	14836.99
CRA-I1	55.4683, -133.39	83.34	-3.39, 9.6, 0.84	1.63	14824.31
CRA-I2	55.5846, -133.183	75.88	-3.3, 9.06, 3.55	2.5	12890.47
CRA-I3	55.6112, -133.114	82.5	-20.2, 9.97, -1.59	4.89	16091.28

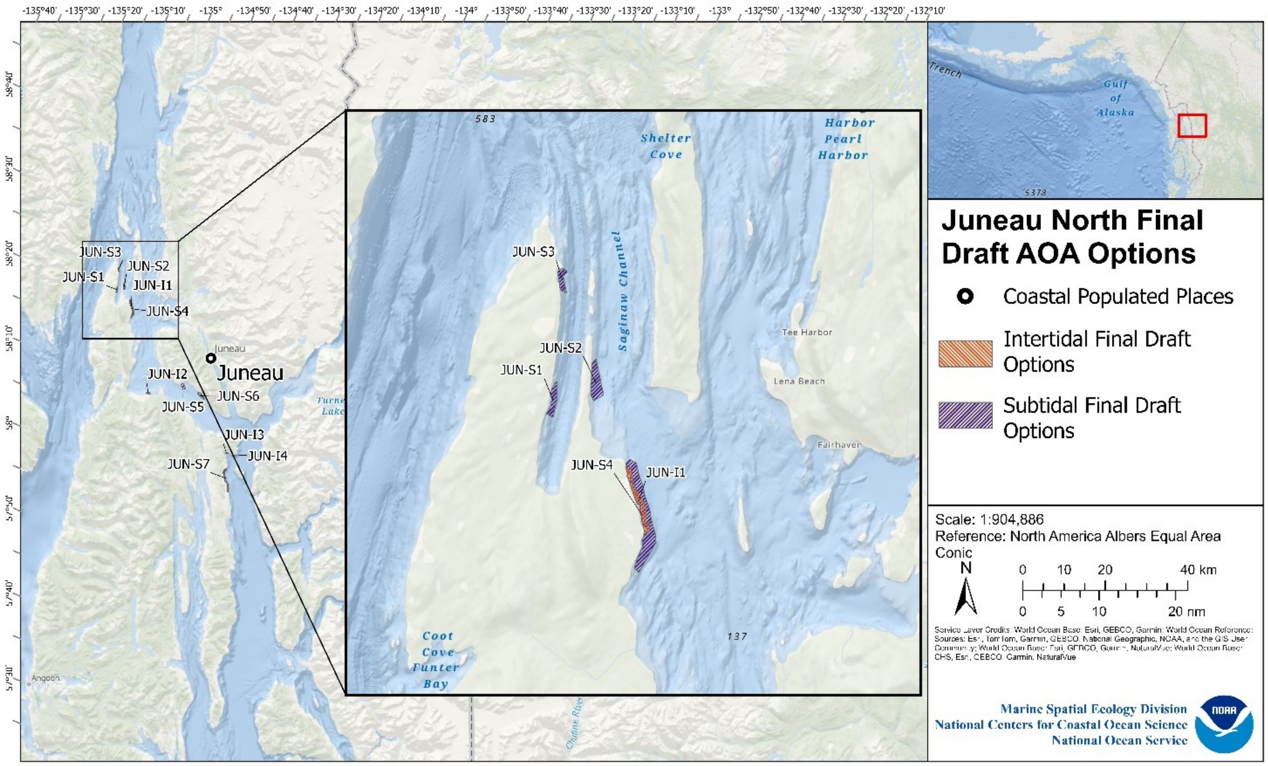
Juneau

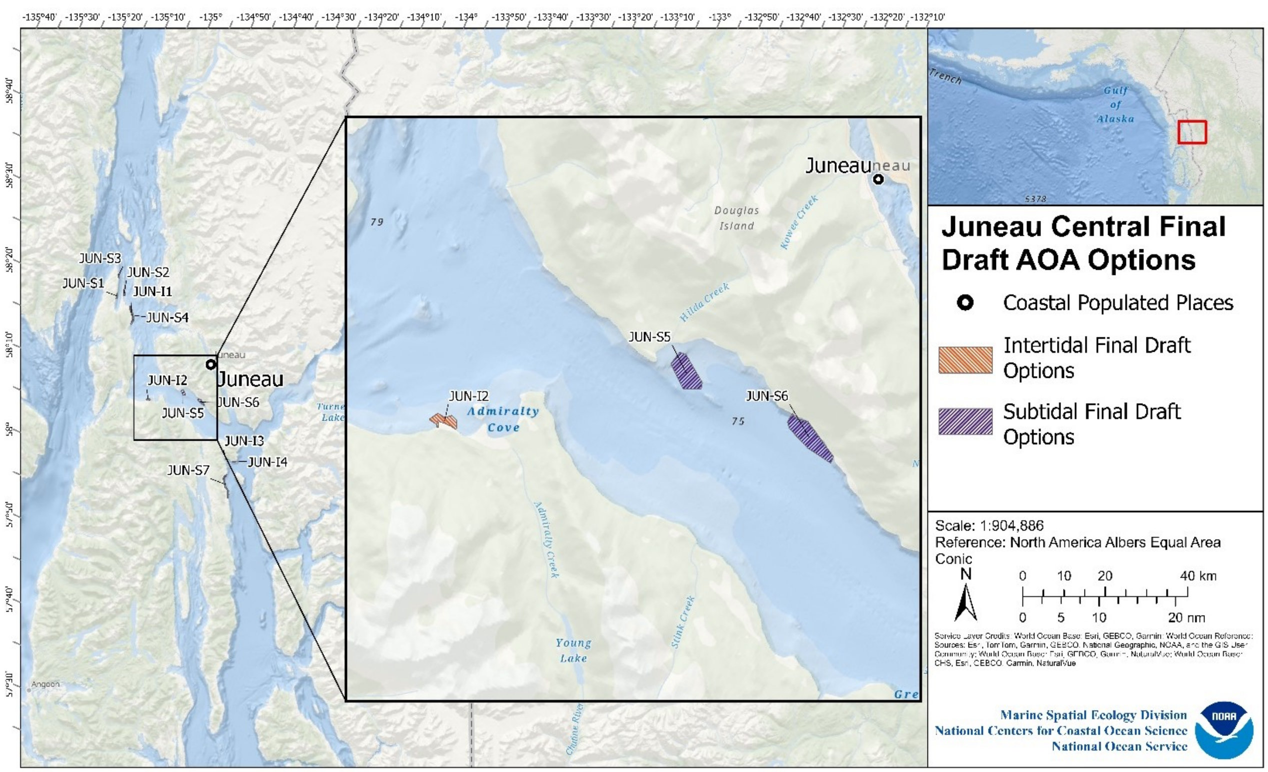
A total of seven subtidal and four intertidal Draft AOA Options were selected for the Juneau study area (Figure 10-11) for a total of 1996 acres. The subtidal clusters totaled 1510 acres with individual options ranging between 52 acres to 447 acres. The intertidal clusters totaled 286 acres with individual options ranging between 28 acres to 143 acres (Table 6).



A. B. C. D.

Figure 8. *Modeling process for the Juneau study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*


Juneau North Final Draft AOA Options
Coastal Populated Places
Intertidal Final Draft Options
Subtidal Final Draft Options
Scale: 1:904,886
Reference: North America Albers Equal Area Conic
N
0 10 20 40 km
0 5 10 20 nm
Marine Spatial Ecology Division
National Centers for Coastal Ocean Science
National Ocean Service
Juneau
JUN-S1
JUN-S2
JUN-S3
JUN-S4
JUN-S5
JUN-S6
JUN-S7
JUN-I1
JUN-I2
JUN-I3
JUN-I4
Saginaw Channel
Shelter Cove
Harbor Pearl Harbor
Tee Harbor
Lena Beach
Fairhaven
Coot Cove
Funter Bay
Gulf of Alaska
Angoon


Juneau Central Final Draft AOA Options
Coastal Populated Places
Intertidal Final Draft Options
Subtidal Final Draft Options
Scale: 1:904,886
Reference: North America Albers Equal Area Conic
N
0 10 20 40 km
0 5 10 20 nm
Marine Spatial Ecology Division
National Centers for Coastal Ocean Science
National Ocean Service
Juneau
JUN-S1
JUN-S2
JUN-S3
JUN-S4
JUN-S5
JUN-S6
JUN-S7
JUN-I1
JUN-I2
JUN-I3
JUN-I4
Douglas Island
Hilda Creek
Admiralty Cove
Admiralty Creek
Young Lake
Stink Creek
Gulf of Alaska
Angoon

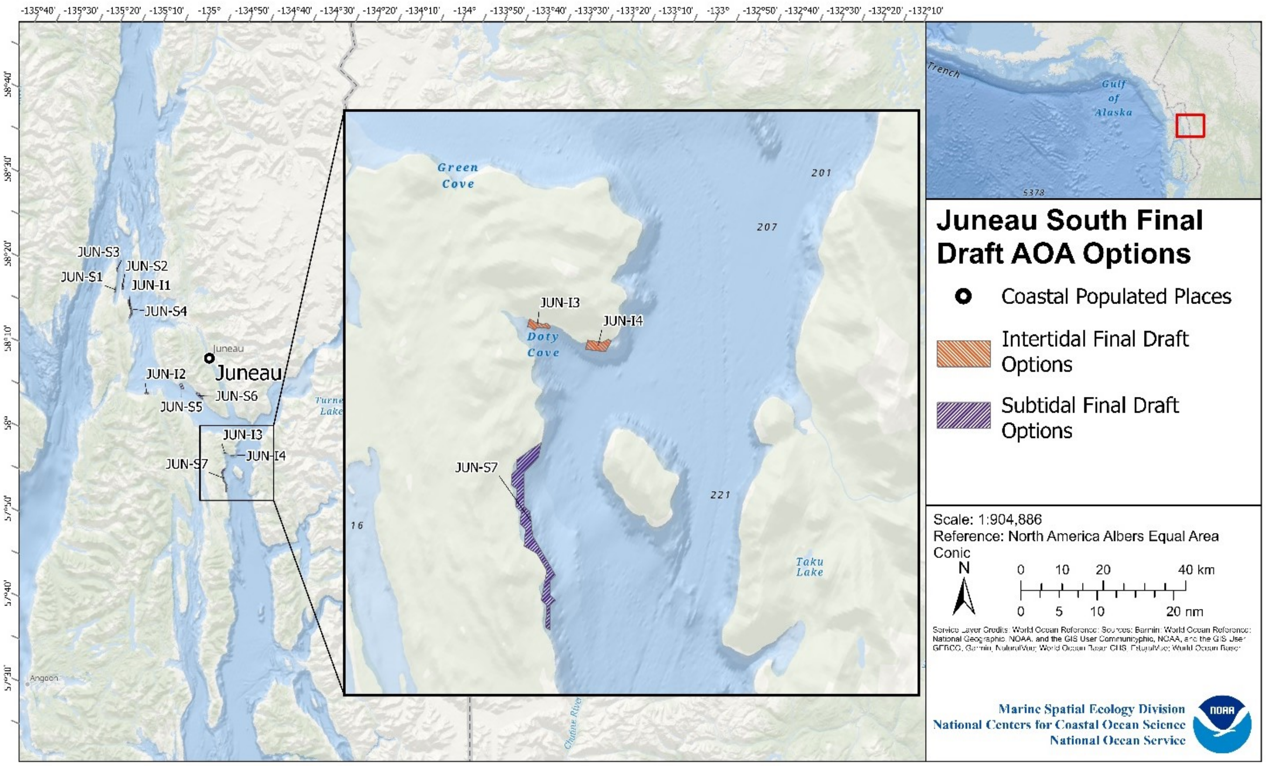


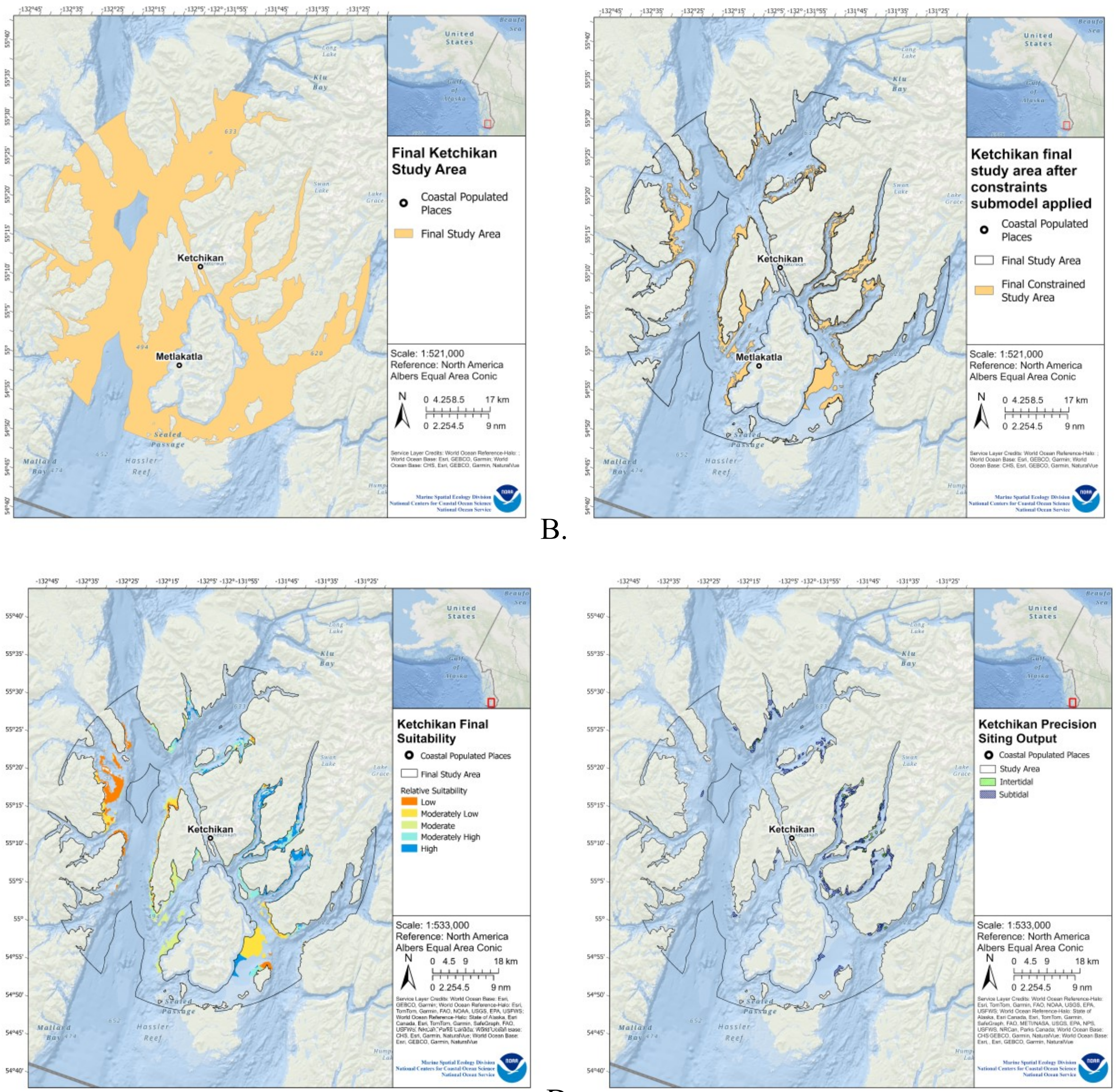
Figure 9. *Final Draft AOA Options for the Juneau study area, top map: Northern extent, middle map: Central extent, bottom map: Southern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

Table 5. *Final Draft AOA Options characterization parameters for the Juneau study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (a)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
JUN-S1	58.3516, -134.9	70.22	0.14, 91.4, 38.52	19.54	33323.97
JUN-S2	58.3636, -134.877	130.24	-2.52, 57.95, 31.83	9.4	28900.6
JUN-S3	58.3926, -134.928	52.63	0.46, 94.56, 39.44	16.84	32637.75
JUN-S4	58.3267, -134.811	433.06	-2.3, 63.26, 22.15	6.82	25057.26
JUN-S5	58.2177, -134.484	205.27	-1.36, 33.06, 24.5	1.66	29049.65
JUN-S6	58.2182, -134.42	246.79	1.24, 57.72, 36.73	5.63	25488.49
JUN-S7	58.0721, -134.17	371.68	-22.27, 64.91, 15.77	11.29	31751.33
JUN-I1	58.3309, -134.817	143.2	-14.67, 29.96, 6.64	6.55	25343.77
JUN-I2	58.1745, -134.607	64.79	-18.14, 17.2, 3.73	5.62	34315.43
JUN-I3	58.1224, -134.209	27.98	-8.83, 43.28, 17.91	14.89	27831.34
JUN-I4	58.1237, -134.175	49.84	-12.52, 67.08, 16.58	13.36	25864.92

Ketchikan

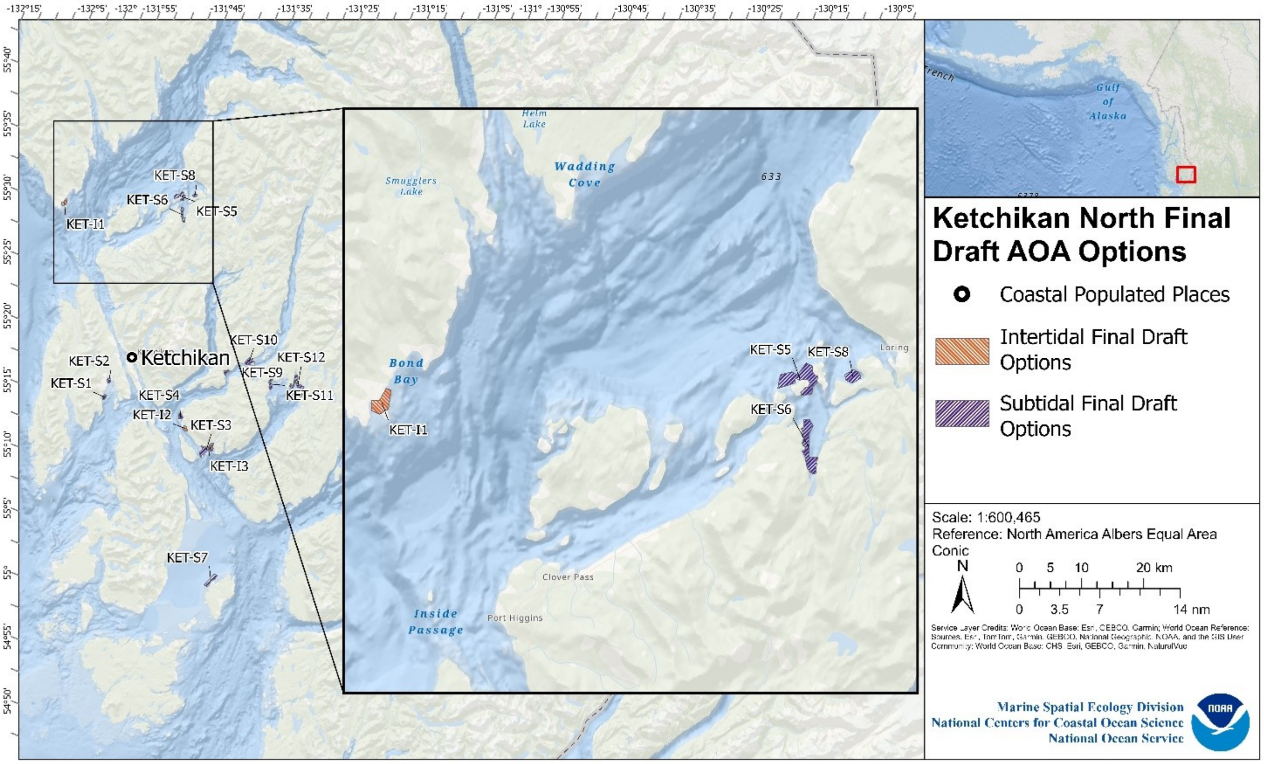
A total of twelve subtidal Draft AOA Options and three intertidal Draft AOA Options were selected for the Ketchikan study area, spanning a total of 2814 acres (Figures 12-13). The subtidal clusters totaled 2532 acres with individual options ranging between 68 acres to 490 acres. The intertidal clusters totaled 282 acres with individual options ranging between 50 acres to 141 acres (Table 7).



A. B.

C. D.

Figure 10. *Modeling process for the Ketchikan study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*



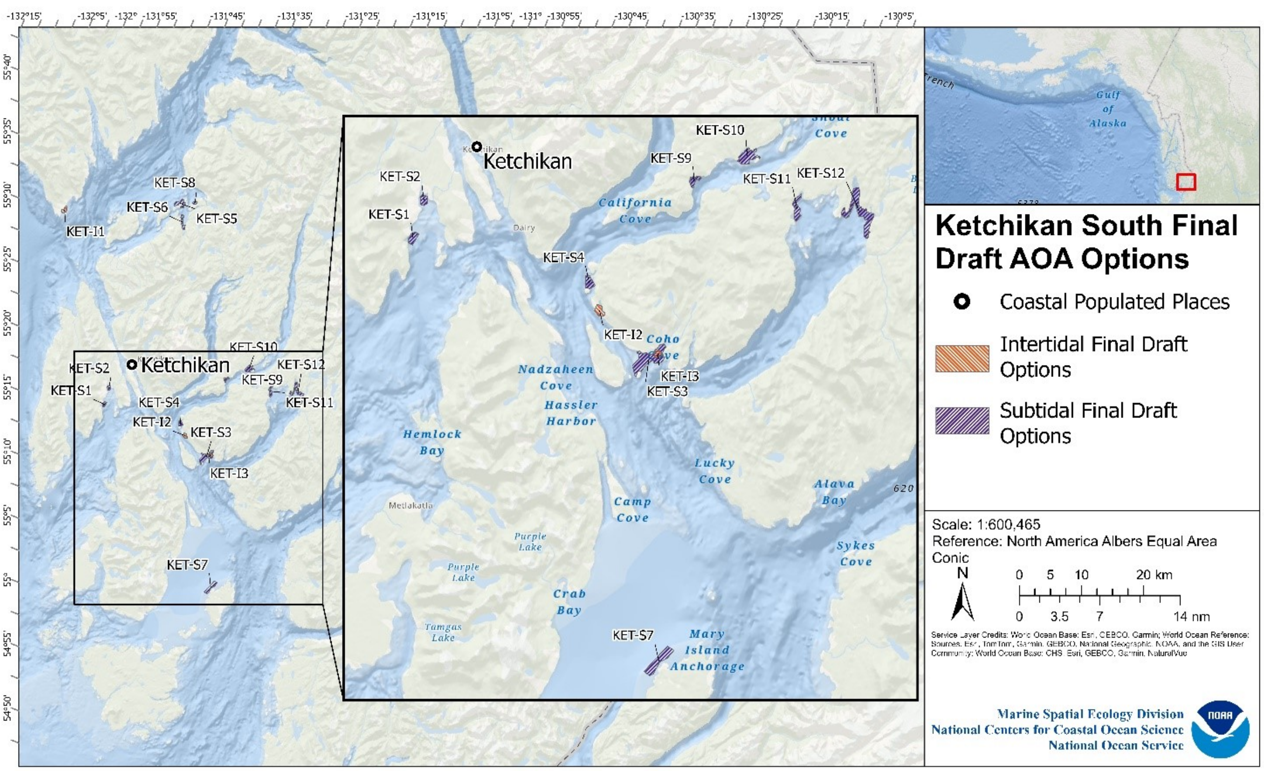


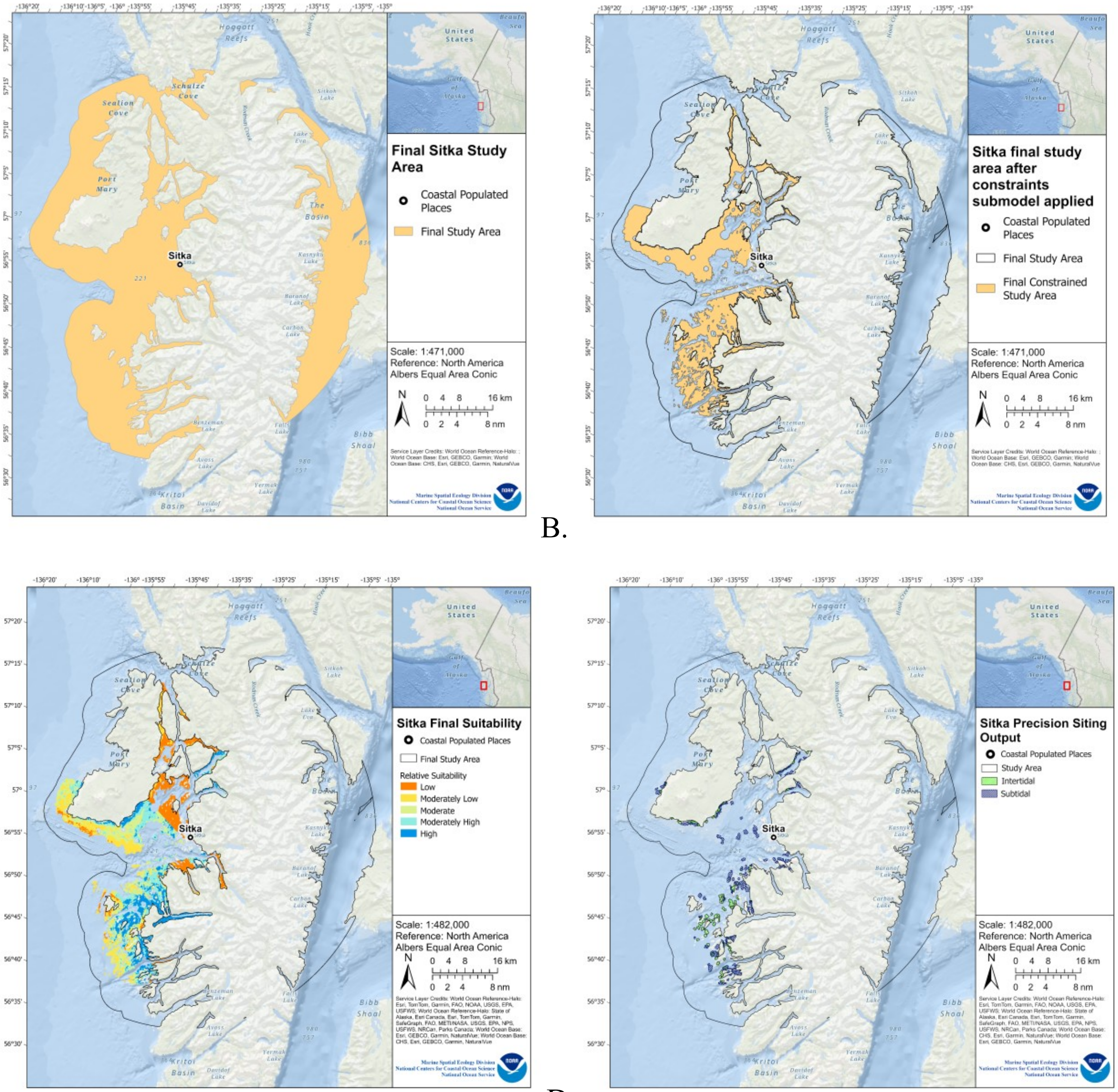
Figure 11. *Final Draft AOA Options for the Ketchikan study area, top map: Northern extent, bottom map: Southern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

Table 6. *Final Draft AOA Options characterization parameters for the Ketchikan study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (a)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
KET-S1	55.2762, -131.679	90	8.51, 48.62, 35.15	4.13	10961.51
KET-S2	55.3, -131.684	79.17	16.95, 32.08, 24.69	2.34	11843.39
KET-S3	55.2603, -131.38	488.23	-10.29, 48.57, 21.39	5.01	19594.48
KET-S4	55.2902, -131.475	106.17	-4.47, 83.06, 36.44	11.59	12932.39
KET-S5	55.5768, -131.687	265.83	-12.04, 101.35, 41.09	11	34757.9
KET-S6	55.5535, -131.663	197.27	-22.09, 81.1, 37.29	15.42	34799.75
KET-S7	55.0923, -131.245	299.72	-1.95, 49.78, 19.97	3.61	38757.69
KET-S8	55.5853, -131.652	68.33	12.76, 65.23, 37.28	6.48	36766.42
KET-S9	55.371, -131.406	78.16	-3.37, 79.43, 38.63	14.55	22308.35
KET-S10	55.3963, -131.359	226.04	-7.81, 28.89, 13.72	4.2	25803.72
KET-S11	55.378, -131.286	143.47	-2.57, 38.29, 16.3	6.15	37673.96
KET-S12	55.3901, -131.218	490.08	-13.36, 80.63, 38.43	11.56	39192.14
KET-I1	55.50828, -131.965	141.67	-34.03, 12.6, -4.36	4.07	27678.48
KET-I2	55.27662, -131.452	90.83	-35.34, 25.28, -2.51	7.15	14672.55
KET-I3	55.26519, -131.373	50	-2.85, 45.85, 17.55	5.66	19938.43

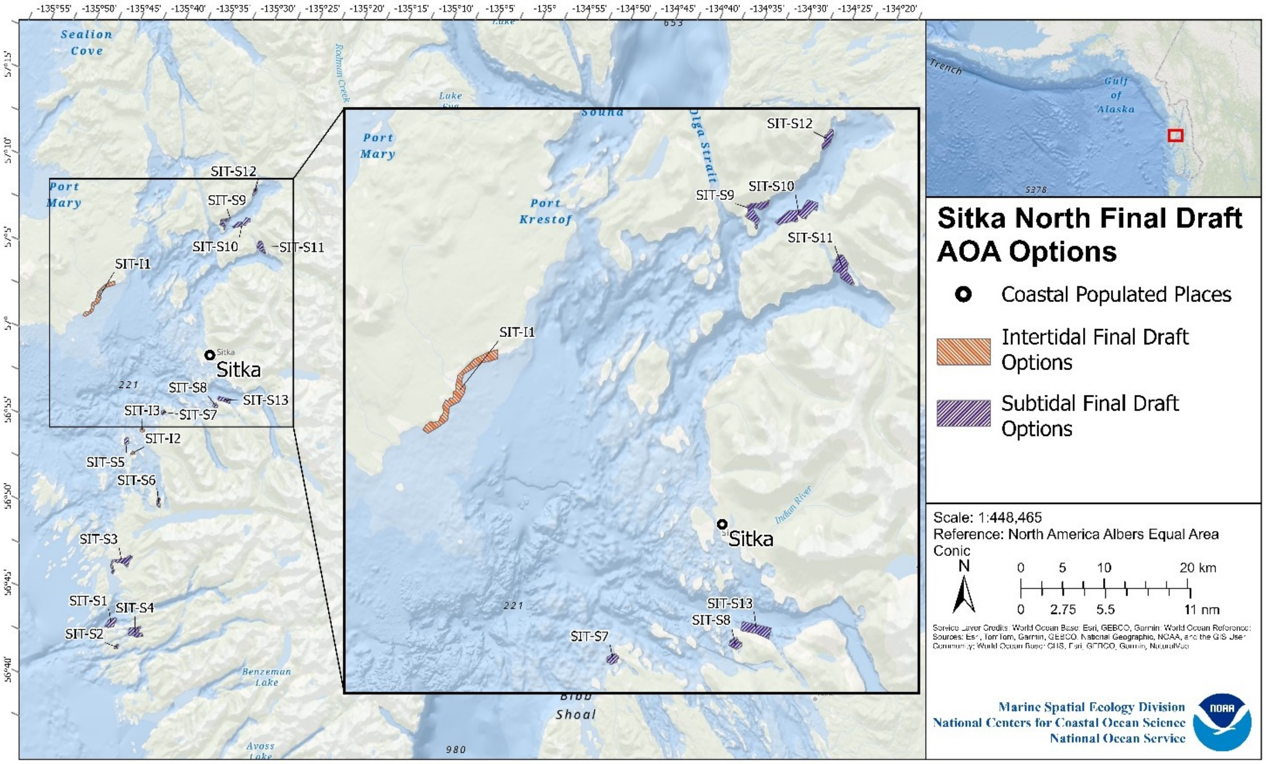
Sitka

A total of thirteen subtidal Draft AOA Options and three intertidal Draft AOA Options were selected for the Sitka study area, spanning a total of 2783 acres (Figure 18-19). The subtidal clusters totaled 2193 acres with individual options ranging between 55 acres to 395 acres. The intertidal clusters totaled 590 acres with individual options ranging between 33 acres to 509 acres (Table 10).



A. B. C. D.

Figure 12. *Modeling process for the Sitka study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*



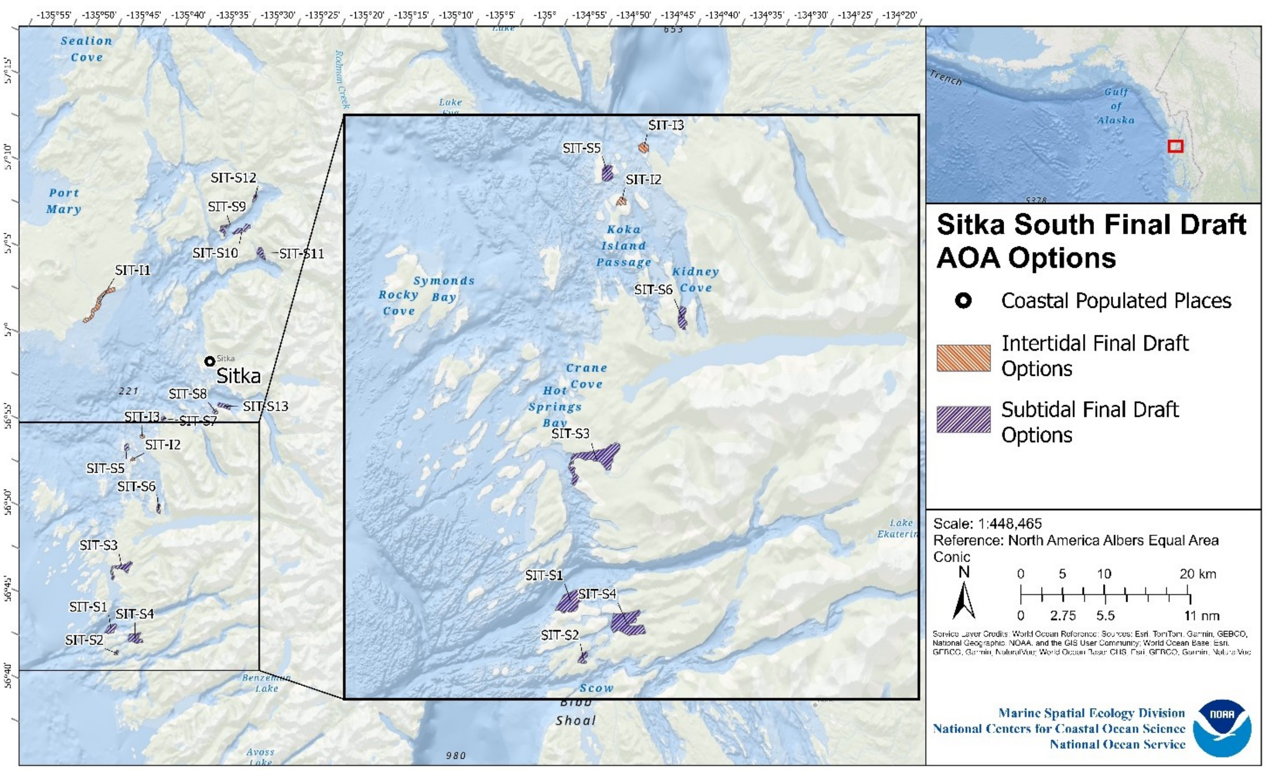


Figure 13. *Final Draft AOA Options for the Sitka study area, top map: Northern extent, bottom map: Southern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

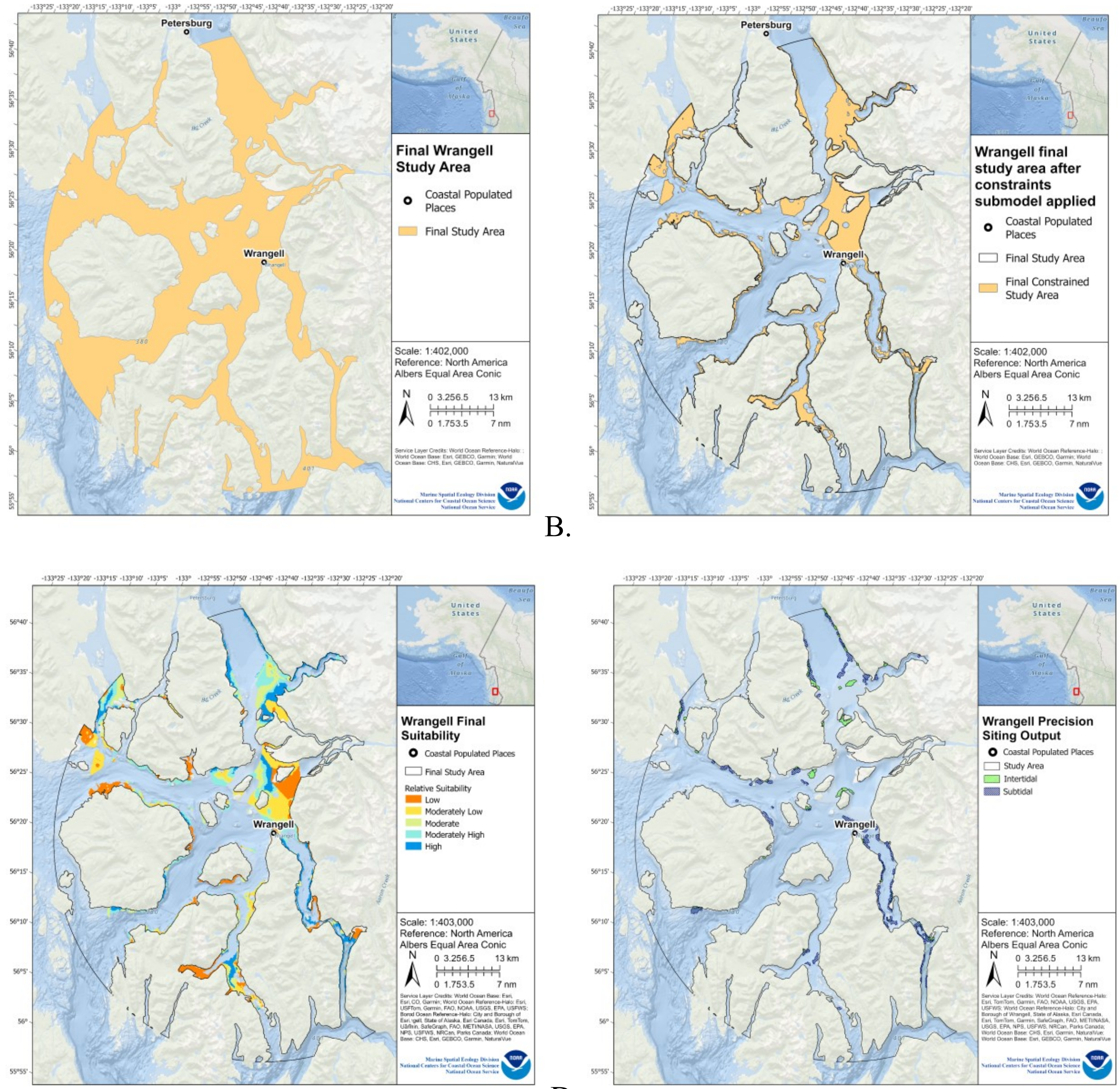
__Table 7.__ Final Draft AOA Options characterization parameters for the Sitka study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.

Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
SIT-S1	56.7539, -135.31	254.42	-3.91, 67.76, 23.43	8.06	36097.94
SIT-S2	56.7329, -135.28	39.9	3.82, 23.29, 13.72	5.85	39757.5
SIT-S3	56.8169, -135.339	395.06	-0.18, 38.78, 17.59	5.11	30096.07
SIT-S4	56.755, -135.258	355.52	1.09, 49.88, 27.79	5.13	38349.06
SIT-S5	56.9357, -135.429	90.78	-3.76, 30.35, 12.94	3.53	14206.29
SIT-S6	56.89, -135.32	91.25	-13.21, 49.44, 32.44	9.9	20802.46
SIT-S7	56.979, -135.385	55.43	-0.59, 24.52, 15.77	3.76	8787.06
SIT-S8	57.0074, -135.293	61.05	-0.14, 33.07, 18.26	4.65	6244.64
SIT-S9	57.1881, -135.427	155.28	-28.36, 76.07, 35.75	14.71	16795.34
SIT-S10	57.1953, -135.393	251.15	-4.27, 82.9, 34.81	8.85	18079.28
SIT-S11	57.1802, -135.338	192.95	-16.71, 109.28, 30.01	12.26	16520.87
SIT-S12	57.2309, -135.396	75.6	-8.63, 57, 23.18	11.22	21903.2
SIT-S13	57.017, -135.282	174.91	7.69, 102.95, 46.17	8.84	5776.84
SIT-I1	57.0616, -135.598	509.24	-34.2, 10.84, 0.15	2.79	15102.53
SIT-I2	56.9268, -135.408	33.34	-9.36, 12.46, -0.36	4.46	14949.21
SIT-I3	56.9528, -135.409	48.05	-5.05, 19.69, 4.05	4.83	12032.06

Wrangell- Petersburg

Results for the Wrangell and Petersburg study areas are presented as a single set of Draft AOA Options due to significant overlap of the highest suitability portions of the two study areas. A total of eight subtidal Draft AOA Options and three intertidal Draft AOA Options were selected for the Wrangell-Petersburg combined study area, spanning a total of 3517 acres (Figure 22-23). The subtidal clusters totaled 3257 acres with individual options ranging between 250 acres to 522 acres. The intertidal clusters totaled 260 acres with individual options ranging between 45 acres to 139 acres (Table 12).

Wrangell



A. B. C. D.

Figure 14. *Grid displaying the modeling process for the Wrangell study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*

Petersburg

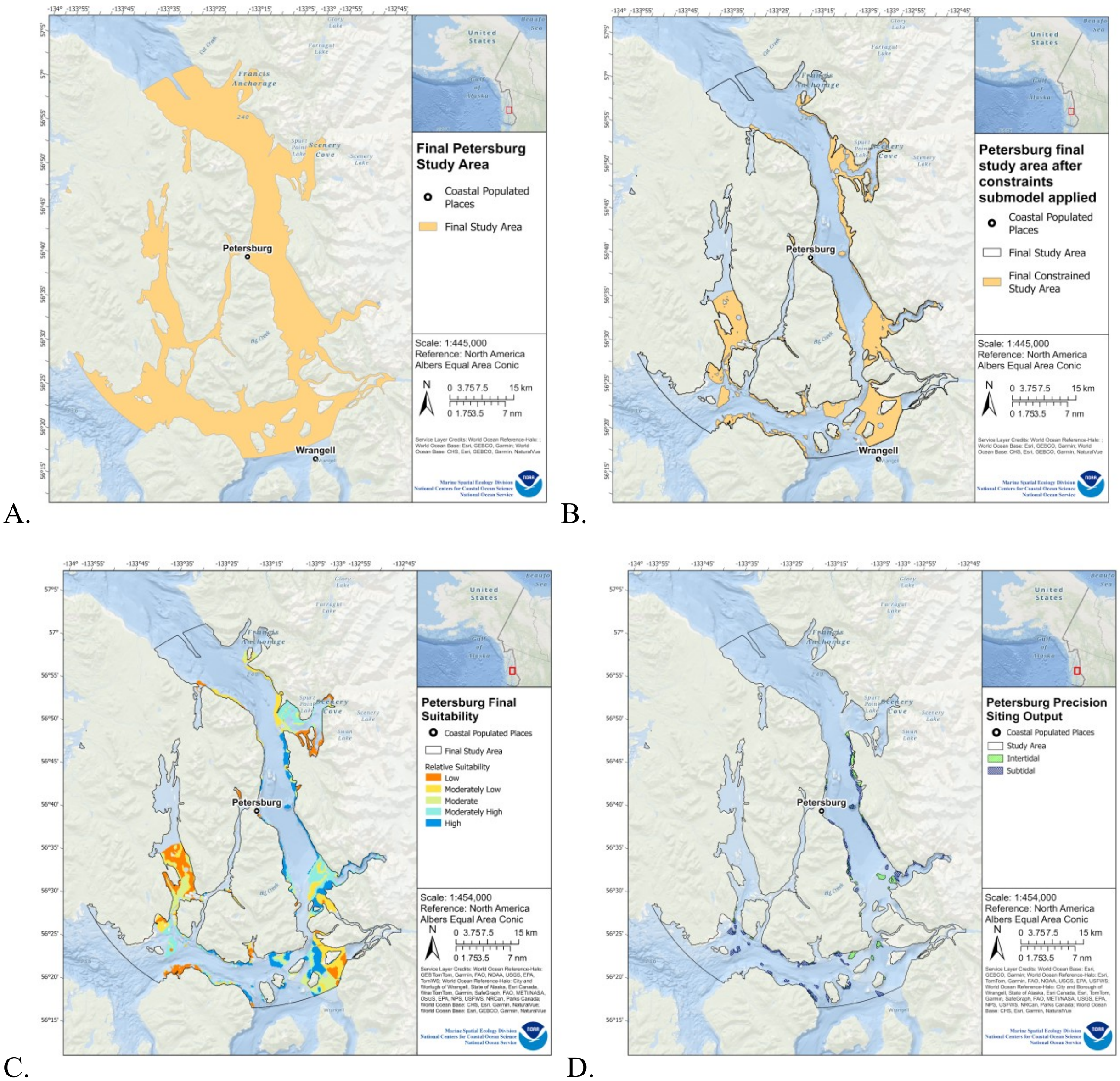
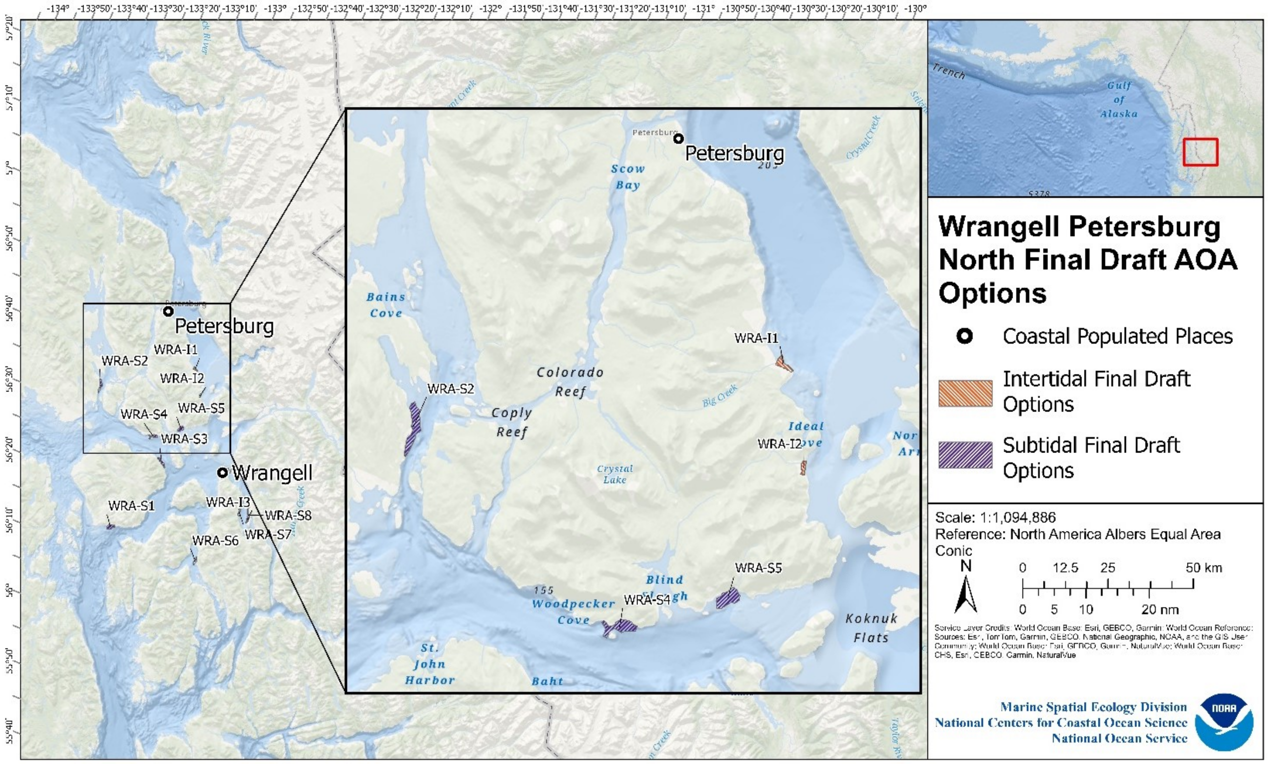


Figure 15. *Modeling process for the Petersburg study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*



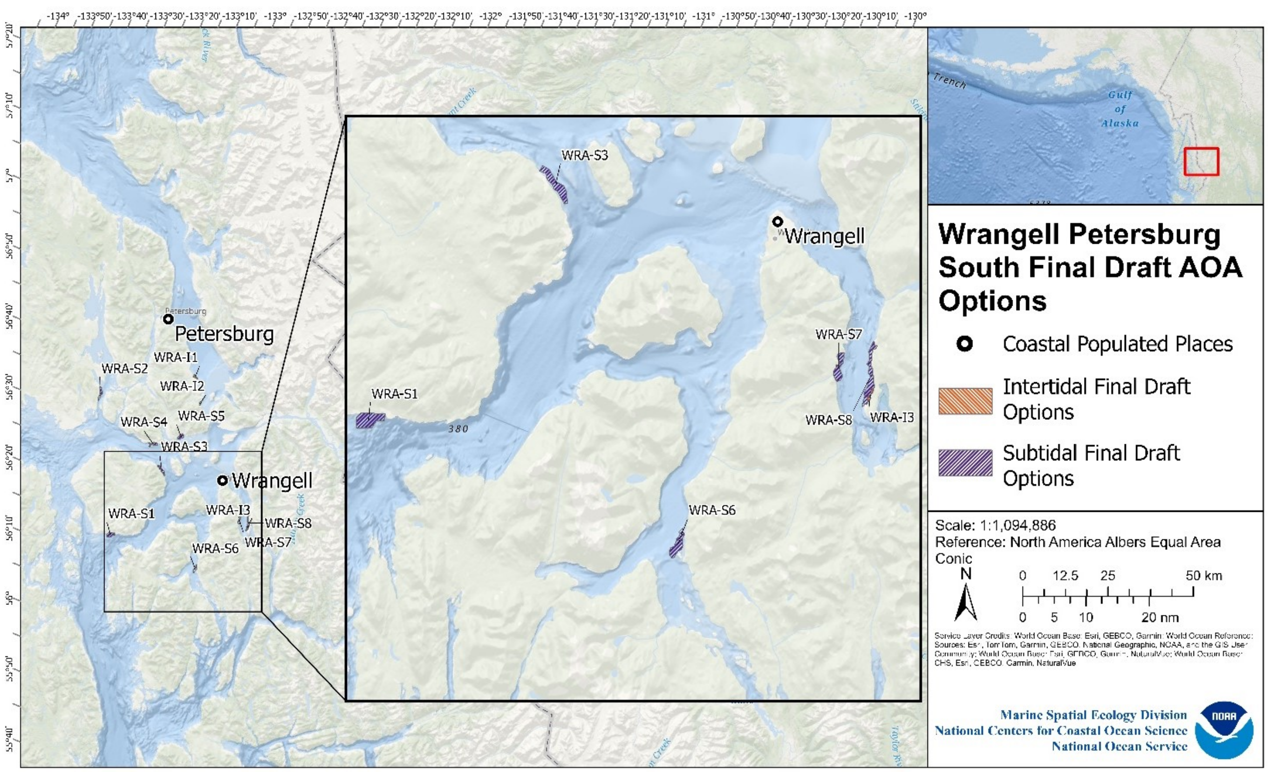


Figure 16. *Final Draft AOA Options for the Wrangell and Petersburg study areas, top map: Northern extent, bottom map: Southern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

Table 8. *Final Draft AOA Options characterization parameters for the Petersburg-Wrangell combined study areas. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
WRA-S1	56.2449, -132.789	522.17	-3.51, 89.38, 36.39	4.93	38828.71
WRA-S2	56.5714, -133.097	494.14	-5.84, 49.21, 21.54	4.83	46503.38
WRA-S3	56.4477, -132.677	436.25	2.06, 102.07, 41.17	7.9	18023.28
WRA-S4	56.5015, -132.763	408.58	-5.25, 76.62, 24.75	5.64	22606.61
WRA-S5	56.5457, -132.651	401.18	-3.47, 32.19, 17.55	2.12	16841.24
WRA-S6	56.245, -132.345	291.16	16.72, 64.79, 44.26	3.05	28842.21
WRA-S7	56.4029, -132.233	249.68	-9.57, 84.65, 30.74	9.72	15344.68
WRA-S8	56.4043, -132.19	454.58	-4.38, 93.14, 37.42	13.04	16274.39
WRA-I1	56.7019, -132.698	139.37	-30.51, 11.89, -5.04	5.01	31272.42
WRA-I2	56.644, -132.625	74.39	-14.64, 0.29, -2.96	1.93	23101.11
WRA-I3	56.3933, -132.181	44.93	-5.21, 23.15, 11.51	8.06	17661.57

Southcentral Alaska

Cordova

A total of six subtidal Draft AOA Options were selected for the Cordova study area (Figure 6-7). The clusters totaled 767 acres with individual options ranging between 49 acres to 178 acres (Table 4). No intertidal options were identified within the study area, due to the steep shoreline conditions and high tidal amplitude.

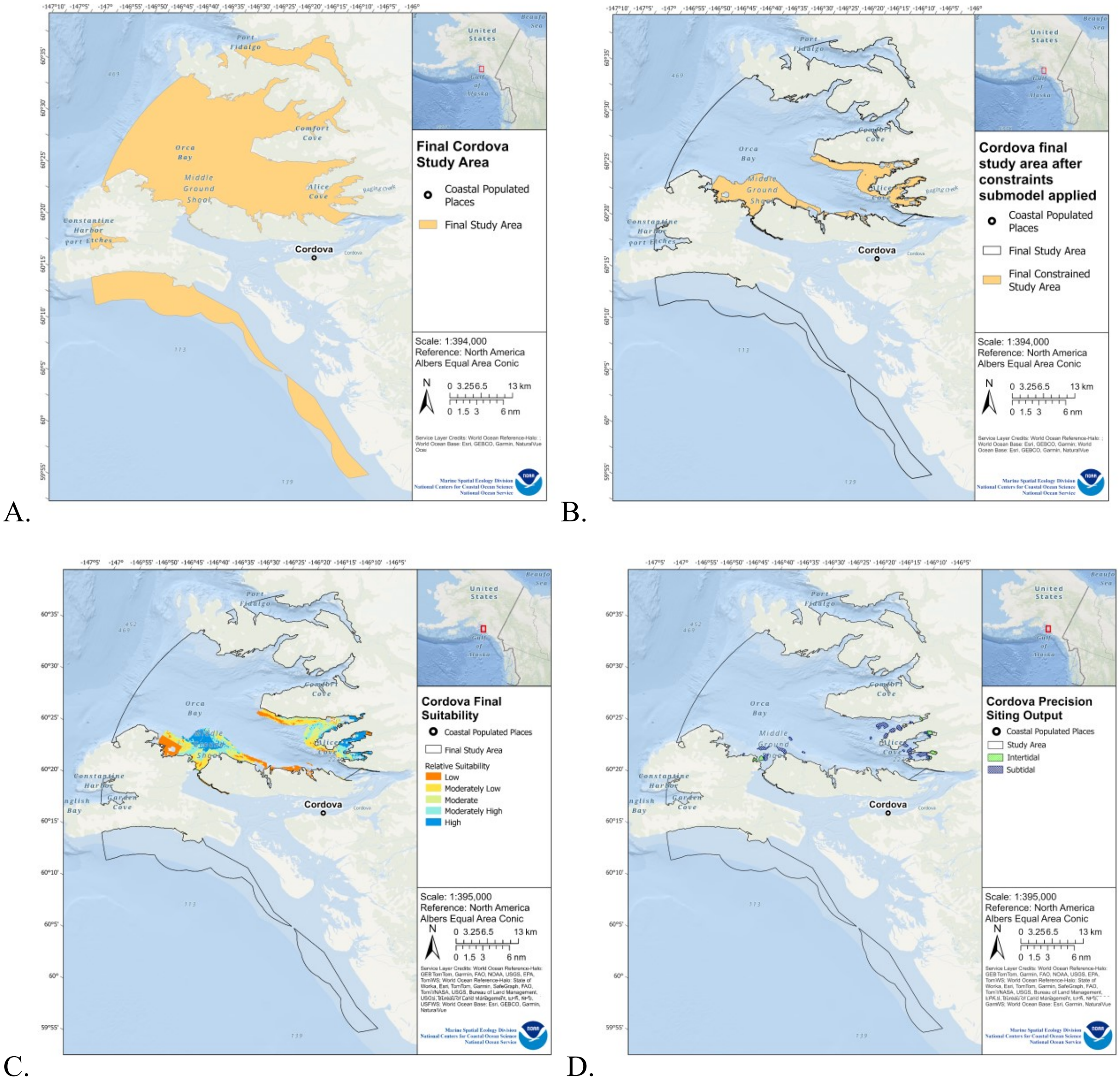


Figure 17. *Modeling process for the Cordova study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*

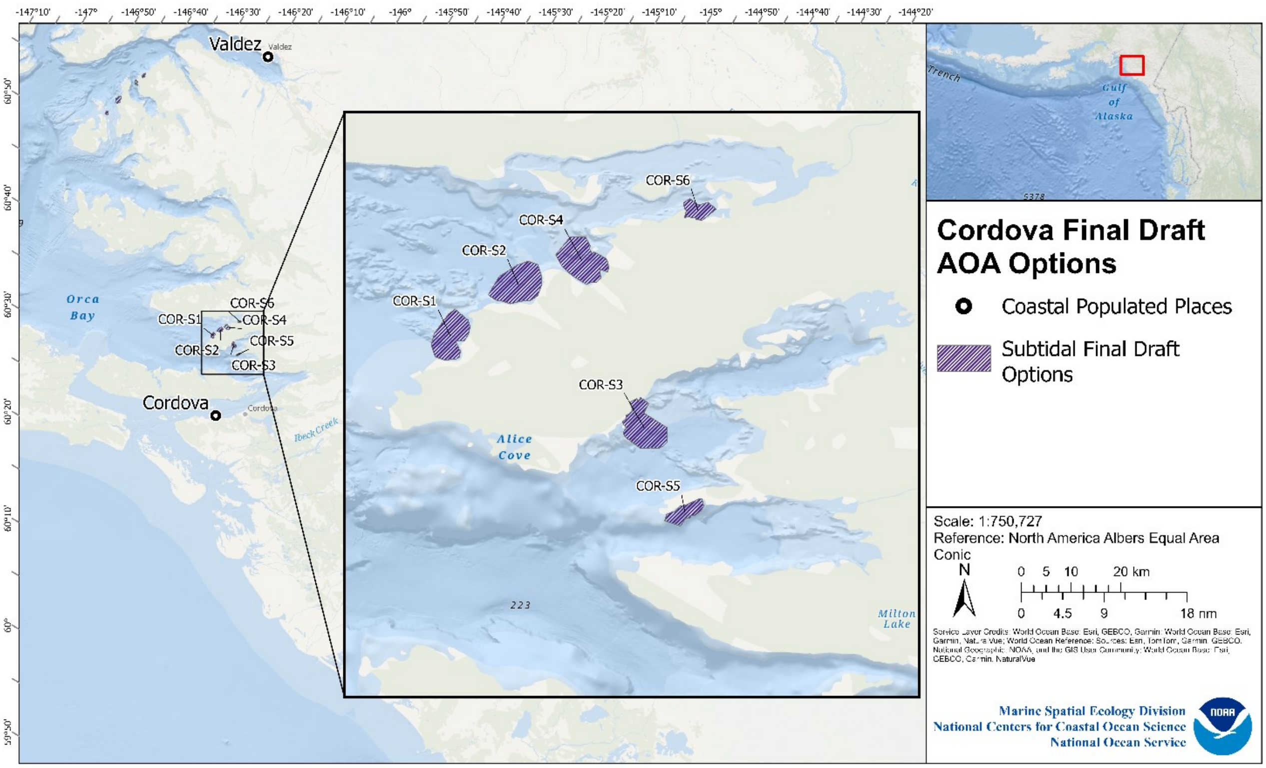


Figure 18. *Final Draft AOA options for the Cordova study area. Subtidal options are displayed in purple. (no intertidal options were selected).*

Table 9. *Final Draft AOA Options characterization parameters for the Cordova study area. Draft Options with an ID including an 'S' denote a subtidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (a)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
COR-S1	60.6367, -146.005	144.59	19.27, 25.64, 22.36	0.63	28840.02
COR-S2	60.6522, -145.992	178.22	24, 27.21, 25.4	0.25	30720.03
COR-S3	60.6403, -145.921	162.5	22.4, 24.49, 23.35	0.14	23882.63
COR-S4	60.6625, -145.975	175.5	21.29, 24.61, 22.74	0.18	32222.73
COR-S5	60.63, -145.89	57.34	20.32, 21.43, 20.82	0.1	22564.4
COR-S6	60.6824, -145.945	48.85	5.32, 9.24, 7.39	0.42	35015.34

Seward

A total of two subtidal Draft AOA Options were selected for the Seward study area (Figure 16-17). The Draft AOA Options spanned a total of 512 acres and ranged from 239 acres to 273 acres (Table 9). No intertidal options were identified within the study area, due largely to the steep shoreline conditions and high tidal amplitude.

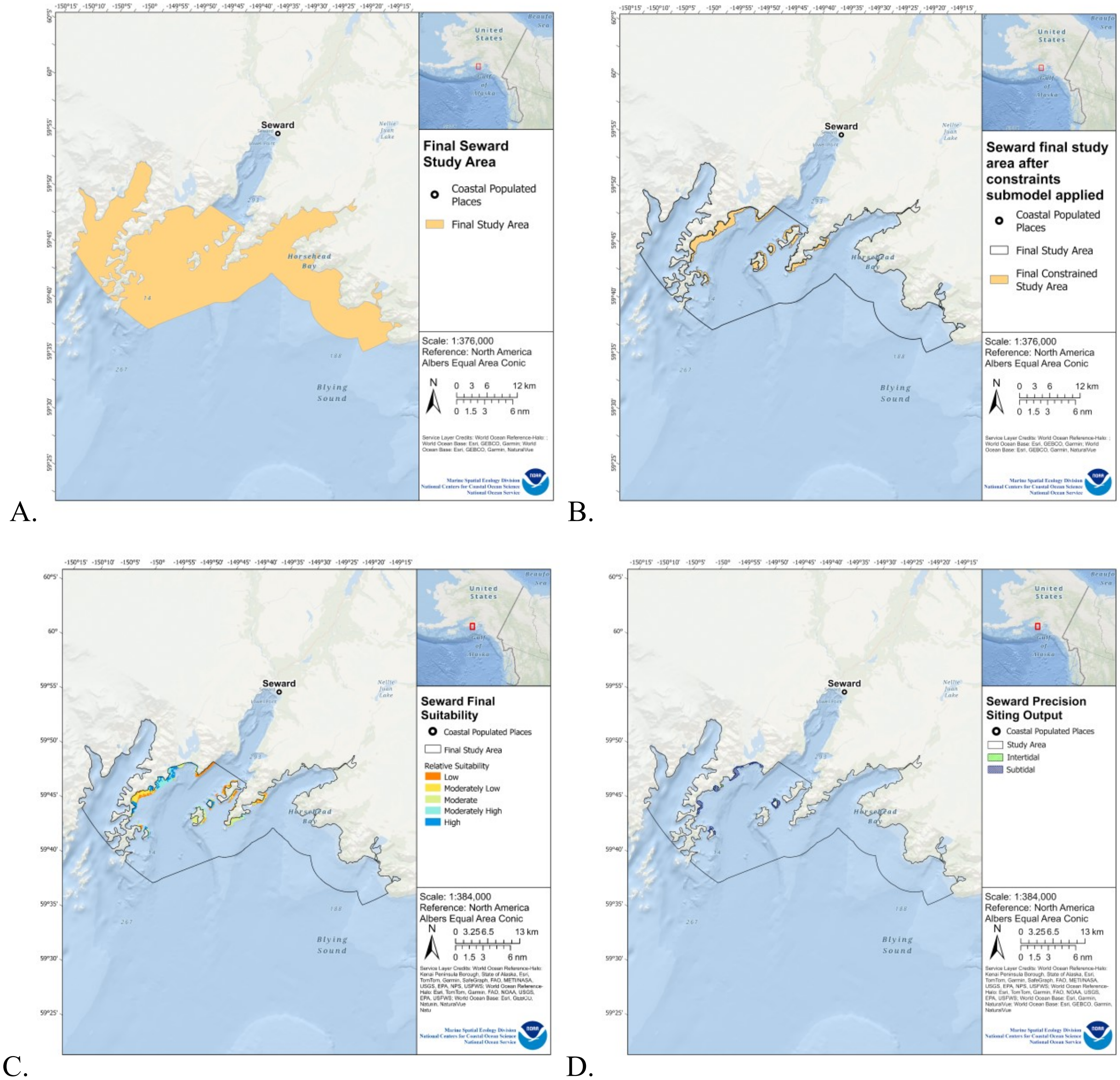


Figure 19. *Modeling process for the Seward study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*

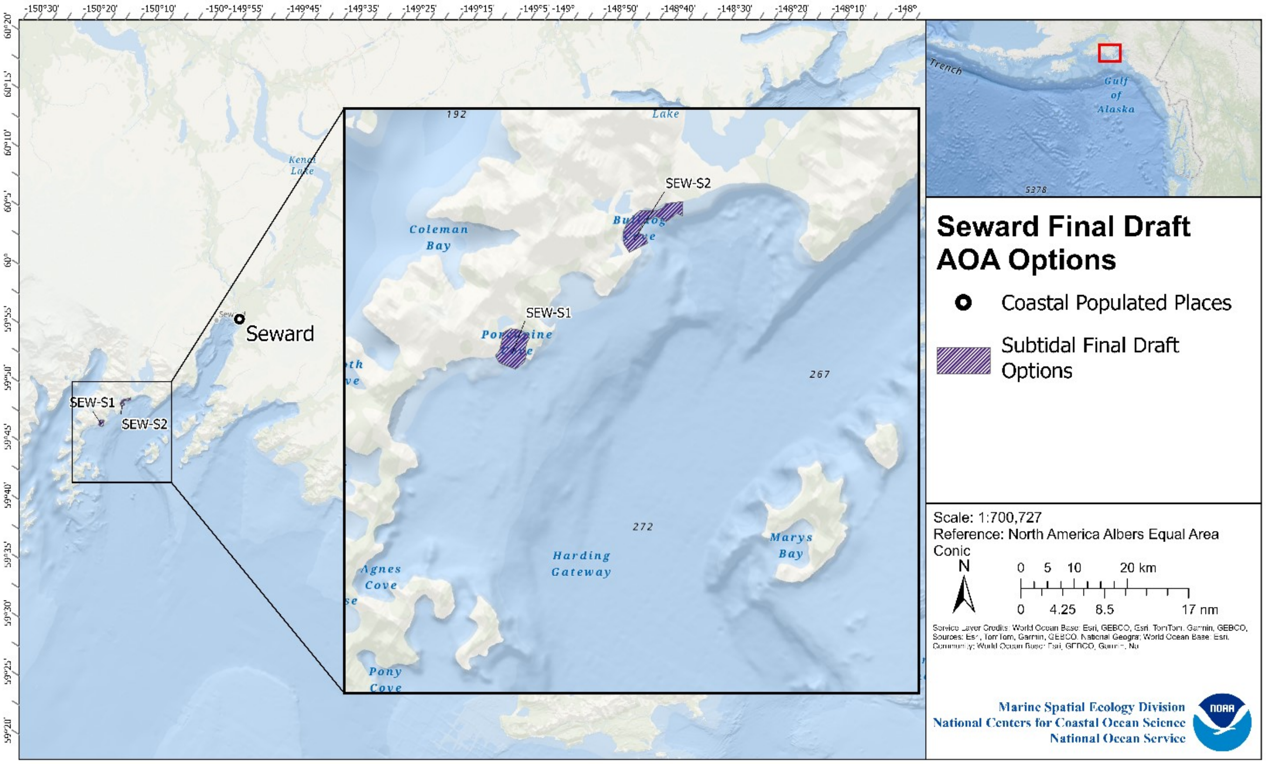


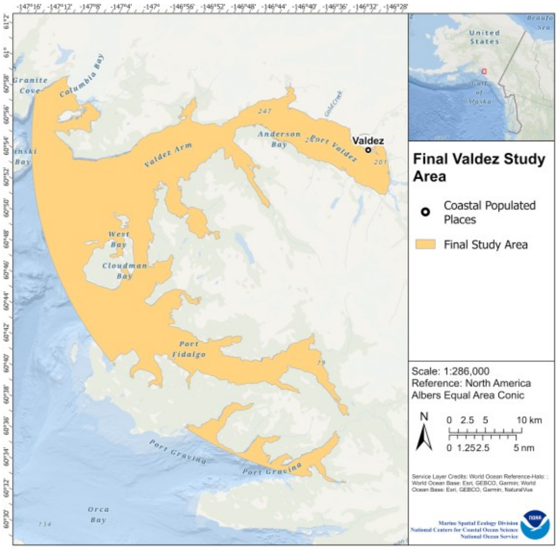
Figure 20. *Final Draft AOA Options for the Seward study area., and subtidal options displayed in purple (No intertidal options were selected).*

Table 10. *Final Draft AOA Options characterization parameters for the Seward study area. Draft Options with an ID including an 'S' denote a subtidal option.*

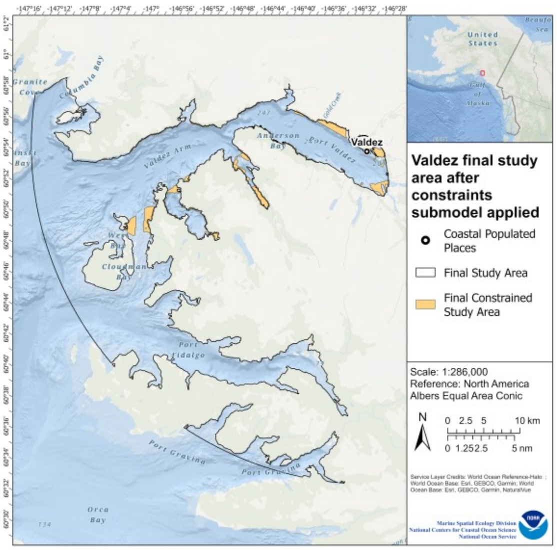
Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
SEW-S1	59.8499, -149.584	239.32	4.31, 38.07, 17.37	1.98	34738.07
SEW-S2	59.9013, -149.557	272.61	3.91, 37.41, 15.9	3.23	29787.61

Valdez

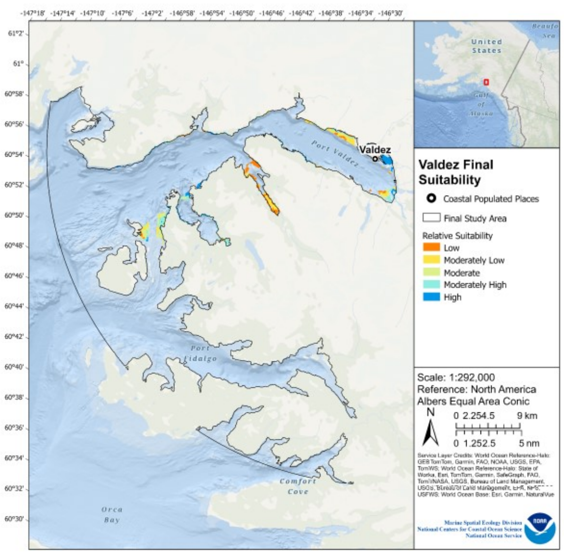
A total of four subtidal Draft AOA Options were selected for the Valdez study area, spanning a total of 537 acres ranging from 86 acres to 260 acres (Figures 20-21, Table 11). No intertidal options were identified within the study area, due largely to the steep shoreline conditions and high tidal amplitude.



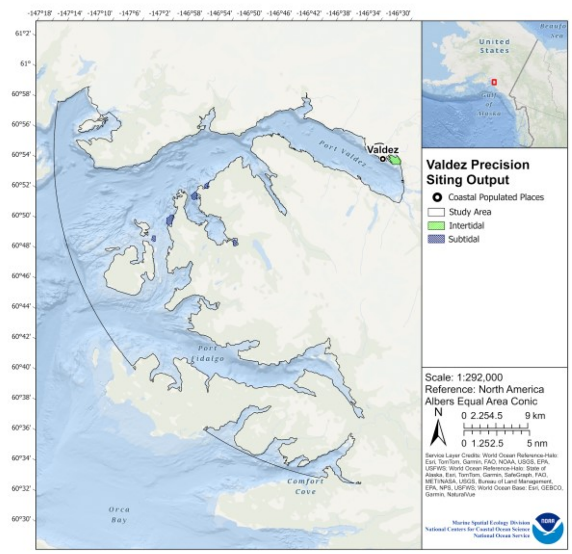
A.



B.



C.



D.

Figure 21. *Modeling process for the Valdez study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*

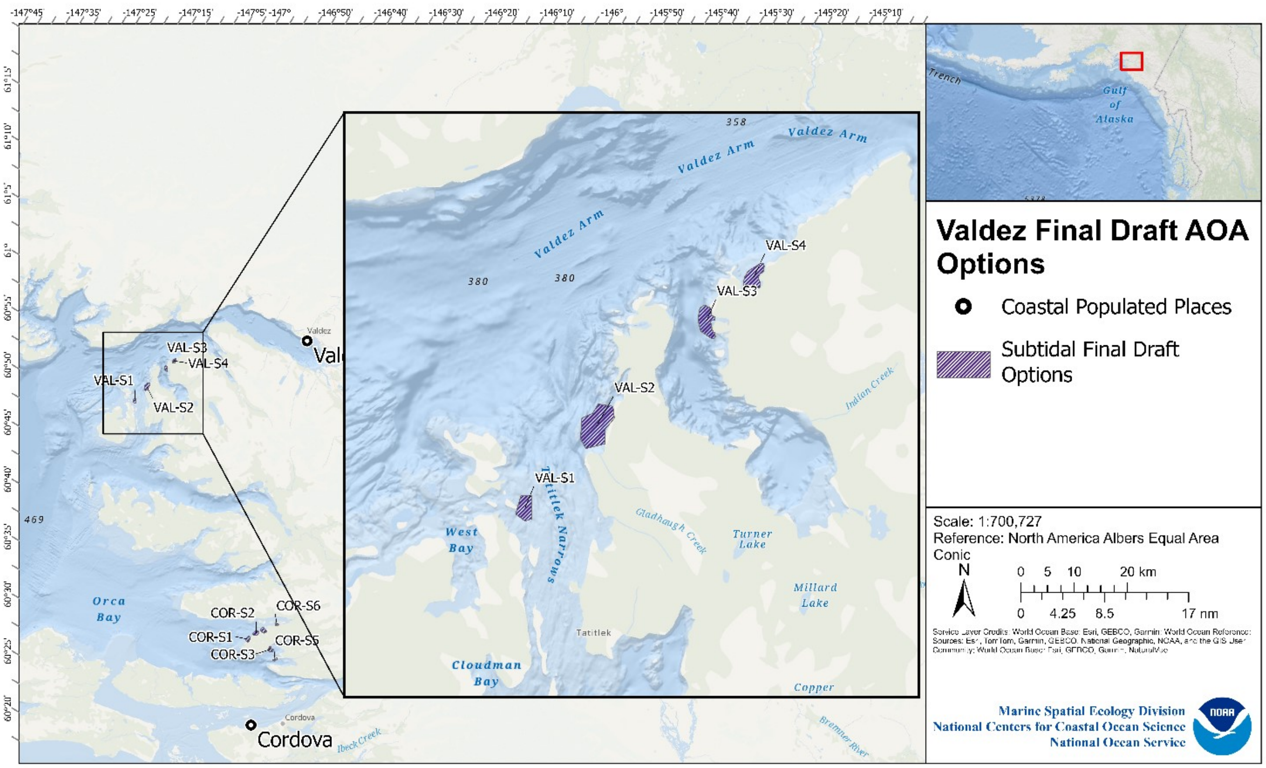


Figure 22. *Final Draft AOA Options for the Valdez study area. Subtidal options are displayed in purple.*

Table 11. *Final Draft AOA Options characterization parameters for the Valdez study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
VAL-S1	60.8876, -146.752	85.83	8.22, 18.34, 12.58	0.75	39979.47
VAL-S2	60.9192, -146.741	260	27.76, 49, 35.25	1.14	36723.7
VAL-S3	60.9623, -146.716	99.05	29.6, 59.43, 44.62	1.7	31105.85
VAL-S4	60.9805, -146.705	92.14	13.13, 62.03, 33.25	2.91	28737.54

Southwest Alaska

Kodiak

A total of thirteen subtidal Draft AOA Options and five intertidal Draft AOA Options were selected for the Kodiak study area, spanning a total of 2600 acres (Figure 14-15). The subtidal clusters totaled 2336 acres with individual options ranging between 64 acres to 396 acres. The intertidal clusters totaled 264 acres with individual options ranging between 27 acres to 78 acres (Table 8).

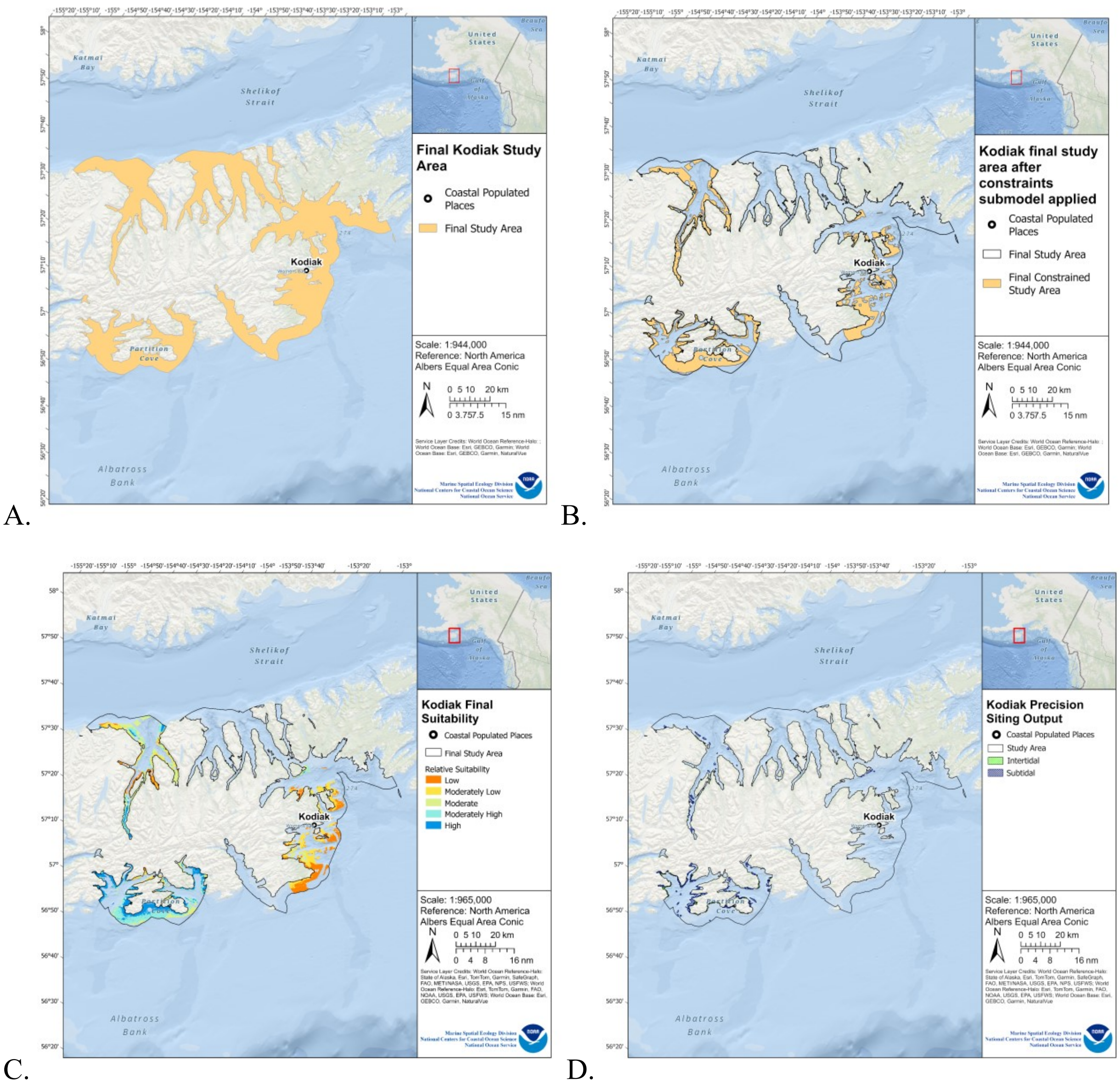
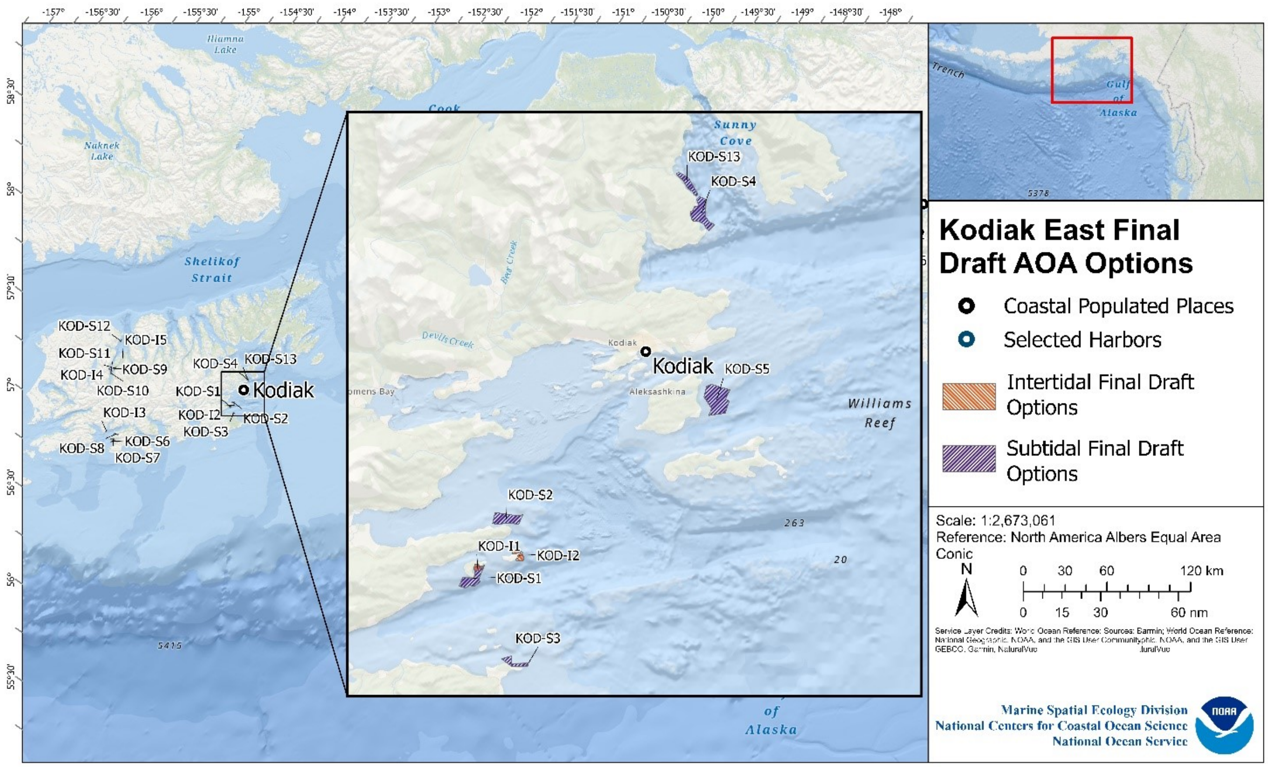
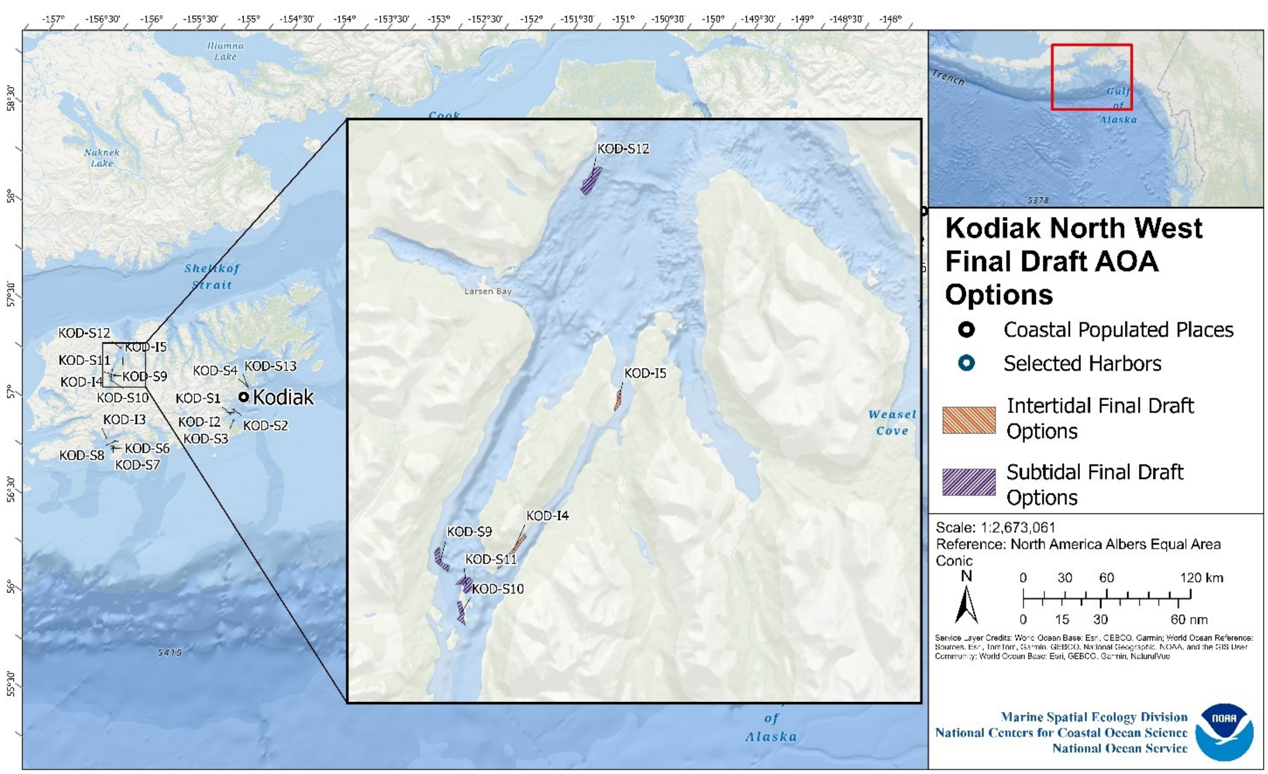


Figure 23. *Modeling process for the Kodiak study area. Top left (A) shows the final study area boundary; top right (B) shows the final study area boundary after all constraints were applied; bottom left (C) shows the output of the spatial suitability analysis, and the bottom right (D) shows the output of the precision siting analysis before the final draft options were selected.*


Kodiak East Final Draft AOA Options
Coastal Populated Places
Selected Harbors
Intertidal Final Draft Options
Subtidal Final Draft Options
Scale: 1:2,673,061
Reference: North America Albers Equal Area Conic
N
0 30 60 120 km
0 15 30 60 nm
Marine Spatial Ecology Division
National Centers for Coastal Ocean Science
National Ocean Service
NOAA
Kodiak
KOD-S1
KOD-S2
KOD-S3
KOD-S4
KOD-S5
KOD-S6
KOD-S7
KOD-S8
KOD-S9
KOD-S10
KOD-S11
KOD-S12
KOD-S13
KOD-I1
KOD-I2
KOD-I3
KOD-I4
KOD-I5
Shelikof Strait
Sunny Cove
Williams Reef
Iliamna Lake
Naknek Lake
Gulf of Alaska
Trench


Kodiak North West Final Draft AOA Options
Coastal Populated Places
Selected Harbors
Intertidal Final Draft Options
Subtidal Final Draft Options
Scale: 1:2,673,061
Reference: North America Albers Equal Area Conic
N
0 30 60 120 km
0 15 30 60 nm
Marine Spatial Ecology Division
National Centers for Coastal Ocean Science
National Ocean Service
NOAA
Kodiak
KOD-S9
KOD-S10
KOD-S11
KOD-S12
KOD-I4
KOD-I5
Larsen Bay
Weasel Cove
Shelikof Strait
Iliamna Lake
Naknek Lake
Gulf of Alaska
Trench

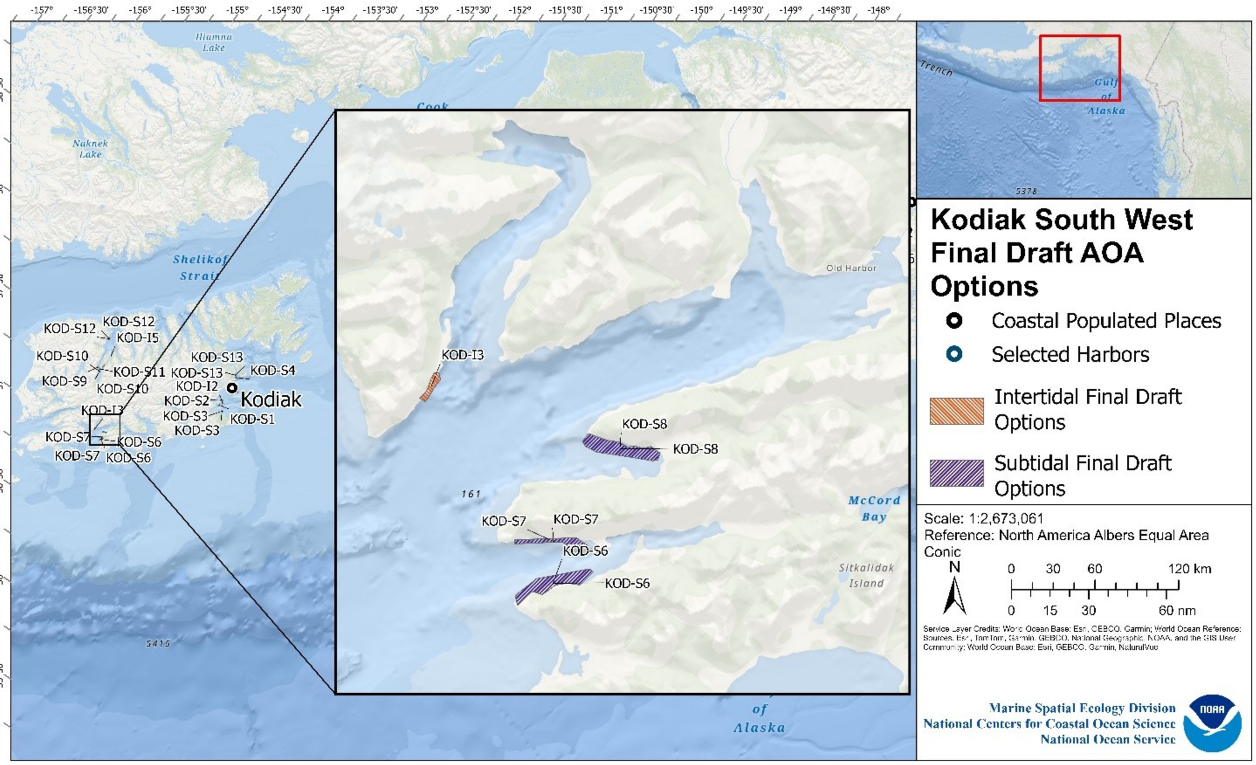


Figure 24. *Final Draft AOA Options for the Kodiak study area, top map: eastern extent, middle map: northwestern extent, bottom map: southwestern extent. Intertidal options displayed in orange, and subtidal options displayed in purple.*

Table 12. *Final Draft AOA Options characterization parameters for the Kodiak study area. Draft Options with an ID including an 'S' denote a subtidal option, and any option with an ID including an 'I' denotes an intertidal option.*

Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
KOD-S1	57.66, -152.4	169.26	2.99, 31.03, 15.73	2.65	14401.36
KOD-S2	57.69, -152.4	181.6	3.16, 20.14, 12.93	1.52	10524.59
KOD-S3	57.64, -152.33	69.3	1.78, 17.37, 7.78	1.89	18135.78
KOD-S4	57.86, -152.41	244.63	1.06, 27.88, 14.43	2.49	15376.77
KOD-S5	57.8, -152.31	396.2	4.54, 29.76, 13.94	1.32	8108.06
KOD-S6	57.06, -153.35	303.55	1.55, 25.61, 11.72	2.86	19922.59
KOD-S7	57.07, -153.36	116.68	2.49, 16.43, 8.52	2.61	19219.91
KOD-S8	57.11, -153.36	326.82	1.62, 30.94, 16.92	1.91	13168.27
KOD-S9	57.42, -153.88	86.43	18.42, 48.6, 32.28	3.25	18586.68
KOD-S10	57.41, -153.84	64.46	27.77, 48.13, 38.56	1.57	21137.42
KOD-S11	57.42, -153.85	105.28	22.77, 46.73, 33.99	3.13	19542.46
KOD-S12	57.61, -153.97	175	35.36, 70.24, 46.71	3.75	9419.75
KOD-S13	57.87, -152.44	96.82	4.16, 15.14, 8.45	1.89	17221.96
KOD-I1	57.66, -152.40	26.64	4, 8.78, 5.5	0.76	13788.95

Final Draft AOA Option ID	Lat, Lng	Area (acre)	Depth MLLW (min, max, avg) (m)	Avg seafloor slope (degree)	Avg distance to cpp (m)
KOD-I2	57.68, -152.38	47.12	3.75, 10.48, 6.89	0.95	12329.1
KOD-I3	57.09, -153.48	67.97	1.21, 8.79, 3.95	1.65	16780.33
KOD-I4	57.44, -153.83	78.43	20.33, 34.54, 27.14	5.12	20710.24
KOD-I5	57.53, -153.83	44.11	14.49, 24.95, 19.37	1.911	12056.49

References Cited

Birch CP, Oom SP, Beecham JA. 2007. Rectangular and hexagonal grids used for observation, experiment and simulation in ecology. Ecological Modeling, 206(3-4): 347-359.

Bovee KD. 1986. Development and evaluation of habitat suitability criteria for use in the instream flow incremental methodology. Instream Flow Information Paper 21, Report 86(7), U.S. Fish and Wildlife Service.

Domisch S, Friedrichs M, Hein T, Borgwardt F, Wetzig A, Jähnig SC, Langhans SD. 2019. Spatially explicit species distribution models: A missed opportunity in conservation planning?. Diversity and Distributions, 25(5), pp.758-769.

Gimpel A, Stelzenmüller V, Grote B, Buck BH, Floeter J, Núñez-Riboni I, Pogoda B, Temming A. 2015. A GIS modelling framework to evaluate marine spatial planning scenarios: co-location of offshore wind farms and aquaculture in the German EEZ. Mar Policy. 55:102–115.

Lightsom FL, Cicchetti G, Wahle CM. 2015. Data categories for marine planning: U.S. Geological Survey open-file report 2015–1046.

Longdill PC, Healy TR, Black KP. 2008. An integrated GIS approach for sustainable aquaculture management area site selection. Ocean and Coastal Management. 51(8–9): 612–624.

Molina JL, Rodríguez-Gonzálvez P, Molina M-C, González-Aguilera D, Balairon L., Espejo Almodóvar F, Montejo J. 2013. River morphodynamics modelling through suitability analysis of geomatic methods. In: Wang Z, Lee JHW, Gao J, Cao S, editors. Proceedings of the 35th IAHR World Congress, Chengdu, China. Beijing: Tsinghua University Press.

Morris JA Jr, MacKay JK, Jossart JA, Wickliffe LC, Randall AL, Bath GE, Balling MB, Jensen BM, Riley KL. 2021. An Aquaculture Opportunity Area Atlas for the Southern California Bight. NOAA Technical Memorandum NOS NCCOS 298. Beaufort, NC. 485 pp.

Muñoz-Mas R, Martínez-Capel F, Schneider M, Mouton AM. 2012. Assessment of brown trout habitat suitability in the Jucar River Basin (Spain): Comparison of data-driven approaches with fuzzy-logic models and univariate suitability curves. Science of the Total Environment. 440:123–131.

Radiarta IN, Saitoh S-I, Miyazono A. 2008. GIS-based multi-criteria evaluation models for identifying suitable sites for Japanese scallop (*Mizuhopecten yessoensis*) aquaculture in Funka Bay, southwestern Hokkaido, Japan Aquacult. 284(1–4):127–135.

Riley KL, Wickliffe LC, Jossart JA, MacKay JK, Randall AL, Bath GE, Balling MB, Jensen BM, Morris JA Jr. 2021. An Aquaculture Opportunity Area Atlas for the U.S. Gulf of Mexico. NOAA Technical Memorandum NOS NCCOS 299. Beaufort, NC. 545 pp.

Silva C, Ferreira JG, Bricker SB, DelValls TA, Martín-Díaz ML, Yáñez E. 2011. Site selection for shellfish aquaculture by means of GIS and farm-scale models, with an emphasis on data poor environments. Aquaculture. 318(3-4):444–457.

Sousa L, Nery F, Sousa R, Matos J. 2006, July. Assessing the accuracy of hexagonal versus square tilled grids in preserving DEM surface flow directions. In Proceedings of the 7th

International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences (Accuracy 2006) (pp. 191-200). Instituto Geográphico Português Lisbon.

Tsatcha D, Saux E, Claramunt C. 2014. A bidirectional path-finding algorithm and data structure for maritime routing. International Journal of Geographical Information Science, 28(7), pp.1355-1377.

Appendix A

This section includes tables of all six submodels used in the suitability model analysis, as well as a table for classification and precision siting modeling. The tables specify datasets, scoring values, and processing descriptions for all submodels.

Table A-1. Constraints submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
Alaska coastline	0	NA	Any areas overlapping with land were removed from consideration.	Alaska Department of Natural Resources (DNR), 2017 March 20: Alaska Coastline 1:63,360. Alaska DNR GIS Public Access Coordinator. https://gis.data.alaska.gov/datasets/SOA-DNR::alaska-coastline/about?layer=4. Date Accessed: 2023-07
Federal and state waters	0	NA	Any area overlapping federal waters was removed to only include areas within state waters.	Office for Coastal Management (OCM), 2019 August 09: Federal and State Waters. NOAA National Centers for Environmental Information, https://www.fisheries.noaa.gov/inport/item/54383. Date Accessed: 2023-07
Bathymetry (mhw, mllw)	0	NA	Multiple bathymetric datasets were mosaiced and the resolution smoothed to create one single bathymetric grid over the entire study region. This rescaled dataset was also shifted in order to create depth datasets at different tide datums.	NOAA National Geophysical Data Center, 2010: Southeast Alaska 8/3 arc-second MHHW Coastal Digital Elevation Model. NOAA National Centers for Environmental Information. https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:715/html# Date Accessed: 2024-06-11 Alaska Fisheries Science Center, 2025: AFSC/RACE/GAP/Zimmermann: Central Gulf of Alaska Grid. NOAA National Centers for Environmental Information, https://www.fisheries.noaa.gov/inport/item/22897 Date Accessed: 2024-06-11. NOAA National Ocean Service Center for Operational Oceanographic Products and Services (CO-OPS), 2024: Station Listings and Tidal Datums. NOAA CO-OPS, https://tidesandcurrents.noaa.gov/ . Date Accessed: 2024-06-11.

Dataset name	Score	Buffer (m)	Processing description	Citation
Maximum sea ice extent	0	NA	Weekly data from 2013-2021 were collected of sea ice extent and a maximum extent was generated.	U.S. National Ice Center, 2020: U.S. National Ice Center Arctic and Antarctic Sea Ice Concentration and Climatologies in Gridded Format, Version 1, Arctic Weekly Sea Ice Concentration and Stage of Development. Boulder, Colorado USA. NSIDC: National Snow and Ice Data Center. https://doi.org/10.7265/46cc-3952 Date Accessed: 2024-06-11.
NWI	0	NA	Filtered out any features that are not marine or estuarine	U. S. Fish and Wildlife Service. 2024 May 1: Wetlands Classification Index, National Wetlands Inventory. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., https://www.fws.gov/program/national-wetlands-inventory Date Accessed: 2024-09-01.
Aids to navigation	0	500		NOAA Office for Coastal Management, 2022 January 7: Aids to Navigation from. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/56120 Date Accessed: 2024-05-20.
Wrecks obstructions	0	152.4		NOAA Office for Coastal Management, 2023 August 1: Wrecks and Obstructions. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/70439 Date Accessed: 2024-05-20.
Deep sea coral	0	1000		Deep Sea Coral Research and Technology Program (DSCRTP), 2016. Observations of Deep-Sea Coral and Sponge Occurrences from the NOAA National Deep-Sea Coral and Sponge Database, 1842-Present, version 20241022-1 (NCEI Accession 0145037). NOAA National Centers for Environmental Information, https://www.ncei.noaa.gov/archive/accession/0145037 Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
NOAA charted submarine cables	0	200		NOAA Office for Coastal Management, 2023: Submarine Cable Areas. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66190 Date Accessed: 2024-05-20.
Submarine cable areas	0	200		NOAA Office for Coastal Management, 2023: Submarine Cable Areas. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66190 Date Accessed: 2024-05-20.
Marine highways	0	500		Audubon Alaska, 2016: Alaska Marine Highway. Alaska Ocean Observing System, https://portal.aoos.org/?portal_id=121#metadata/d87622e4-5735-11e9-84f0-0023aeec7b98/2b010340-6e05-11e9-9316-0023aeec7b98 Date Accessed: 2024-05-20.
Ferry routes	0	500		Bureau of Transportation Statistics, Census Bureau, the US Geological Survey, the National Oceanic and Atmospheric Association, and the US Army Corps of Engineers, 2020 December 31: Ferry Routes. U.S. Department of Transportation, https://data-usdot.opendata.arcgis.com/datasets/usdot::ferry-routes/about Date Accessed: 2024-05-20.
Aquatic farm permit lease	0	50	Filtered to only include active aquatic permits	Alaska Department of Fish and Game (ADF&G), 2019. Active Aquatic Farming Operation Areas. ADF&G, https://gis.adfg.alaska.gov/mapping/rest/services/CF_public/Aquatic_Farming_Operations/MapServer/2 Date Accessed: 2024-05-20.
Active aquatic operating areas	0	0		Alaska Department of Fish and Game (ADF&G), 2023: Anadromous Waters Catalog. ADF&G, https://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=maps.dataFiles Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
Anadromous streams	0	91.5		Alaska Department of Natural Resources (DNR), 2019 September 9: State Park Boundary. Alaska DNR - Information Resource Management, https://gis.data.alaska.gov/datasets/SOA-DNR::state-park-boundary/about Date Accessed: 2024-05-20.
State parks	0	100		Alaska Department of Natural Resources (DNR), 2019 September 9: State Park Boundary. Alaska DNR - Information Resource Management, https://gis.data.alaska.gov/datasets/SOA-DNR::state-park-boundary/about Date Accessed: 2024-05-20.
Offshore seafood processors Permitted Vessels	0	0		Alaska Department of Environmental Conservation (DEC), 2019 April 18: AKG523000 Offshore Seafood Processors Permitted Vessels. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=6 Date Accessed: 2024-05-20.
Alaska WQ monitoring locations	0	0		Alaska Department of Environmental Conservation (DEC), 2001 April 4 - 2014 July 1: Alaska DEC Water Quality Monitoring Locations. Alaska DEC, https://gis.data.alaska.gov/datasets/agio-hub::alaska-dec-wq-monitoring-locations/about Date Accessed: 2024-05-20.
Harbor seal haulout buffers	0	0	Filtered to only include key haulouts	London, J.M., K.M. Yano, E.L. Richmond, D.E. Withrow, S.P. Dahle, J.K. Jansen, H.L. Ziel, G.M. Brady, and P.L. Boveng (2015). Observed Haul-out Locations for Harbor Seals in Coastal Alaska. Alaska Fisheries Science Center, National Oceanic and Atmospheric Administration, https://services2.arcgis.com/C8EMgrsFcRFL6LrL/ArcGIS/rest/services/pv_cst_haulout/FeatureServer Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
Environmental sensors and buoys	0	500		National Data Buoy Center, 2024: Marine Observations by Program. NOAA National Weather Service, https://www.ndbc.noaa.gov/ Date Accessed: 2024-05-20.
Maintained channels	0	0		NOAA Office of Coast Survey (OCS), 2001 July 11 - 2024: Coastal Maintained Channels in US waters. NOAA OCS, https://www.fisheries.noaa.gov/inport/item/39972 Date Accessed: 2024-05-20.
Wastewater pipes	0	500		NOAA Office of Coast Survey (OCS), 2001 July 11 - 2024: Coastal Maintained Channels in US waters. NOAA OCS, https://www.fisheries.noaa.gov/inport/item/39972 Date Accessed: 2024-05-20.
Ferry terminals	0	350		NOAA Office for Coastal Management, 2022: Wastewater Outfalls. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66706 Date Accessed: 2024-05-20.
Seafood discharge locations	0	0		Alaska Department of Environmental Conservation (DEC), 2021: Seafood Processing Discharge Locations. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=3 Date Accessed: 2024-05-20.
Seafood permitted outfalls	0	500		Alaska Department of Environmental Conservation (DEC), 2019: AKG130000 Permitted Outfall. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=12 Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
Seafood processing permitted net pens	0	0		Alaska Department of Environmental Conservation (DEC), 2019: AKG130000 Permitted Net Pens. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=13 Date Accessed: 2024-05-20.
Seafood processing permitted carcass disposal	0	0		Alaska Department of Environmental Conservation (DEC), 2019: AKG130000 Permitted Carcass Disposal Site. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=14 Date Accessed: 2024-05-20.
Seafood processing facility locations	0	0		Alaska Department of Environmental Conservation (DEC), 2019: Seafood Processing Facility Locations. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-dec-seafood-processing-facilities/about?layer=2 Date Accessed: 2024-05-20.
Poa navigation projects	0	500		U.S. Army Corps of Engineers (USACE), 2020: USACE Alaska District (POA) Navigation Projects. USACE, https://www.arcgis.com/home/item.html?id=42c90d4ccb724d76b352989d4e50c4c0 Date Accessed: 2024-05-20.
Ocean disposal sites	0	0		NOAA Office for Coastal Management, 2018 July 3: Ocean Disposal Sites. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/5413 Date Accessed: 2024-05-20.
AK state game refuges/ critical habitats/ sanctuaries	0	0		Alaska Department of Environmental Conservation (DEC), 2018: Alaska State Game Refuges, Critical Habitat, Sanctuaries. Alaska DEC, https://data-soa-adec.opendata.arcgis.com/maps/cb8dedcef13349869476925969e73a99/explore?location=54.444381%2C20.123400%2C4.94 Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
Poa erosion protection	0	500		U.S. Army Corps of Engineers (USACE), 2022: USACE Alaska District (POA) Erosion Protection and Flood Mitigation Projects. USACE POA, https://www.arcgis.com/home/item.html?id=28100079ec164f7494fb524b2644b312 (deprecated), https://www.poa.usace.army.mil/About/Offices/Construction-Operations/Erosion-and-Flood-Mitigation/ Date Accessed: 2024-05-20.
Danger zones and restricted areas	0	0		NOAA Office for Coastal Management, 2022 July 1: Danger Zones and Restricted Areas. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/48876 Date Accessed: 2024-05-20.
Fiber optic networks	0	200		Alaska Department of Natural Resources (DNR), 2023: Fiber-Optic Cable, Cook Inlet subset. Alaska DNR, https://data-soa-dnr.opendata.arcgis.com/datasets/SOA-DNR::fiberoptic-cable-163360-1/about Date Accessed: 2024-05-20.
Land status within the National Wildlife Refuge	0	0	Filtered to only include Afognak and Womens Bay submerged lands	U.S. Fish & Wildlife Service (USFWS) Region 7, Division of Realty & Conservation Planning, 2024: Land Status within the National Wildlife Refuges of Alaska. USFWS, https://www.arcgis.com/home/item.html?id=3eed8d6b30ea443dafe4380d70d0fa5e Date Accessed: 2024-05-20.
Oil and gas pipeline	0	500		NOAA Office for Coastal Management, 2024: Pipelines. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66172 Date Accessed: 2024-05-20.

Dataset name	Score	Buffer (m)	Processing description	Citation
Shipping lanes	0	500		NOAA Office of Coast Survey (OCS), 2024: Shipping Fairways, Lanes, and Zones for US waters from 2001-07-11 to Present. NOAA OCS, https://www.fisheries.noaa.gov/inport/item/39986 Date Accessed: 2024-05-20.
AK area plans	0	0	Used to create Alaska area plans aquaculture exclusion layer by filtering for areas that include explicit exclusion of aquatic farming	Alaska Department of Natural Resources - Information Resource Management, 2020: Area and Management Plan Boundary. https://data-soa-dnr.opendata.arcgis.com/datasets/99120ebf1efc40e4a4774eca6fb00c7a_19/about Date Accessed: 2024-05-14.
OCS navigation charts-islands	0	0	Filtered to include any island that covers at least 80% of a grid cell	NOAA Office of Coastal Survey (OCS), 2024: ENC Approach Coastline Line. ENC Direct to GIS, https://nauticalcharts.noaa.gov/learn/encdirect/#map-services Date Accessed: 2024-08. NOAA Office of Coastal Survey, 2024: ENC Harbor Coastline Line. ENC Direct to GIS, https://nauticalcharts.noaa.gov/learn/encdirect/#map-services Date Accessed: 2024-08.
Stellar sea lion major haulouts and rookeries	0	500	Filtered to include any major haulouts and rookeries	Protected Resources Division, NOAA Fisheries, Alaska Region (AKR), 2024. AKR Protected Resources Division (PRD) Data Layers and Scoring for Aquaculture Opportunity Atlas (Atlas). NOAA Technical Memorandum, U.S. Department of Commerce. Juneau (AK).
Anchorages	0	0		NOAA Office for Coastal Management, 2023: Anchorages. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/48849 Date Accessed: 2024-07-17

Dataset name	Score	Buffer (m)	Processing description	Citation
SEAK closed waters salmon net fisheries	0	0	Filter to only include Annette Islands Reserve	Alaska Department of Fish and Game (ADF&G), 2023: SEAK Closed Waters Salmon Net Fisheries poly. ADF&G Commercial Fisheries Division, https://gis.data.alaska.gov/datasets/adfg::seak-closedwaters-salmonnetfisheries-poly/about Data Accessed: 2024-02-10
AOOS sensors locations	0	0		National Ocean Services, (2024, November): NOAA Center for Operational Oceanographic Products and Services (CO-OPS). CO-OPS, https://tidesandcurrents.noaa.gov/ Date Accessed: 2024-10-16.
Navy undersea cables	0	500	Classified information	Department of Defense, 2024: CUI Undersea Cables. NOAA Office of Coast Survey (via secure file exchange), Controlled Unclassified Information (CUI), unpublished. Date Received: 2024-11-24.
Harbors	0	500		Alaska Department of Transportation and Public Facilities (ADOTPF), 2024: Harbors. ADOTPF, https://gis.data.alaska.gov/pages/9f00b292e3154ab2a4b62384e727ab07 Date Accessed: 2024-09-24.
Coastal populated places (cpp)	1	40233.6	Filtered to include any place which has at least one thousand residents. Layer was used to calculate both straight line and travel distance from cpp, where any area outside of the 40233.6m (25 nautical mile) buffer was given a score of zero and removed.	NOAA Office for Coastal Management, 2024: Coastal Populated Places. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66114 Date Accessed: 2023-12-05.

Table A-2. Cultural resources submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
Historic lighthouses	0.5	500		NOAA Office of Coastal Management, 2018 July 17: Historic Lighthouses. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/54384 Date Accessed: 2024-09-24.
Alaska area plans	0.5	0	Filtered to include areas including heritage sites and community harvest sites	Alaska Department of Natural Resources - Information Resource Management, 2020: Area and Management Plan Boundary. https://data-soa-dnr.opendata.arcgis.com/datasets/99120ebf1efc40e4a4774eca6fb00c7a_19/about Date Accessed: 2024-01-15.
ADF&G Southeast Alaska herring surveys	Binned categorical; 0-0.5 occurrences per year = 1 >0.5 occurrences per year = 0.5	0	A 100m buffer was applied to survey line data, and then divided number of occurrences per relative ten year period to get an occurrences per year layer	Alaska Department of Fish and Game (ADF&G), 2020-2024. Southeast Alaska Herring Surveys. ADF&G, https://services.arcgis.com/VdkVOAHovLuozJG4/arcgis/rest/services/CF_Southeast_AK_HerringSurveys_Public_View/FeatureServer/2 Date Accessed: 2024-06-25.
Pacific herring spawning areas	0.5	0		NOAA Office of Response and Restoration (ORR), 1997-2023. Download ESI Maps and GIS Data - Pacific Herring Spawning Areas (for Kodiak and Seaward). NOAA ORR, https://response.restoration.noaa.gov/esi_download Date Accessed: 2024-06-25.

Dataset name	Score	Buffer (m)	Processing description	Citation
Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska	Binned categorical; 0-0.5 occurrences per year = 1 >0.5 occurrences per year = 0.5	0	Divided number of occurrences per relative ten year period to get an occurrences per year layer	Morella, J 2023. Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska, 1973-2021. Dataset. 10.24431/rw1k440, 10.24431/rw1k441. Date Accessed: 2024-06-25.
Northern sea otter Abundance and distribution on the Kodiak Archipelago	Density in top 75th percentile given score of 0.5	0	Applied a kernel density estimate function to the data to estimate sea otter hotspots	Cobb M. 2018. Northern sea otter (*Enhydra lutris*) Abundance and distribution on the Kodiak Archipelago. Refuge Report 2018.2, Kodiak National Wildlife Refuge, U.S. Fish and Wildlife Service, Kodiak, AK. Date Accessed: 2024-06-25.
Abundance and distribution of sea otters (*Enhydra lutris*) in the Southcentral Alaska stock, 2014, 2017, and 2019	Density in top 75th percentile given score of 0.5	0	Applied a kernel density estimate function to the data to estimate sea otter hotspots	Esslinger, G.G., Robinson, B.H., Monson, D.H., Taylor, R.L., Esler, D., Weitzman, B.P., and Garlich-Miller, J., 2021, Abundance and distribution of sea otters (*Enhydra lutris*) in the southcentral Alaska stock, 2014, 2017, and 2019: U.S. Geological Survey Open-File Report 2021–1122, 19 p., https://doi.org/10.3133/ofr20211122 Date Accessed: 2024-06-25.

Dataset name	Score	Buffer (m)	Processing description	Citation
Northern sea otter (*Enhydra lutris kenyoni*) population abundance and distribution across the Southeast Alaska stock summer 2022	Density in top 75th percentile given score of 0.5	0		Schuette, P., Eisaguirre, J., Weitzman, B., Power, C., Wetherington, E., Cate, J., Womble, J., Pearson, L., Melody, D., Merriman, C., Hanks, K., Esslinger, G. 2023. Northern Sea Otter (*Enhydra lutris kenyoni*) Population Abundance and Distribution across the Southeast Alaska Stock Summer 2022. USFWS Region 7 Technical Report MMM 2023-01, U.S. Fish and Wildlife Service, Alaska Region Headquarters, Anchorage, AK. https://www.fws.gov/media/usfws-region-7-technical-report-mmm-2023-01-march-2023 Date Accessed: 2024-06-25.
Alaska Heritage Resources Survey (AHRS) data	0.5	500		Alaska Department of Natural Resources (DNR), Office of History and Archaeology, Alaska Heritage Resources Survey (AHRS), 2024: AHRS Sites. Alaska DNR, https://dnr.alaska.gov/parks/oha/ahrs/ahrs.htm Date Accessed: 2024-12-04.

Table A-3. Fisheries submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
Shore fishery lease	0.5	0		Alaska Department of Natural Resources (DNR) - Information Resource Management, 2023: Shore Fishery Lease. Alaska DNR, https://data-soa-dnr.opendata.arcgis.com/datasets/SOA-DNR::shore-fishery-lease/about Date Accessed: 2024-09-24.
Hatchery release sites	0.5	500		DFGCWTOTOP database [Internet]. 1976 - present. Juneau, AK: Alaska Department of Fish and Game, Division of Commercial Fisheries, Mark, Tag and Age Laboratory. Cited 2025. Available from: https://mtalab.adfg.alaska.gov/CWT/reports/default.aspx Date Accessed: 2024-06-04.

Dataset name	Score	Buffer (m)	Processing description	Citation
Commercial fisheries landings	Continuous	0	Fisheries landings data were joined to statistical areas dataset to create a spatial data layer using both salmon and groundfish stat areas. A combined fisheries layer was created by calculating fishing effort per acre for each fishery, and then a final minimum value was calculated.	NOAA National Marine Fisheries Service (NMFS), 2024: Commercial Fisheries Landings. NOAA NMFS (via secure file exchange), Controlled Unclassified Information (CUI), unpublished. Date Acquired: 2024-09-10.
ADFG statistical areas		0	Use as a spatial reference for the commercial fisheries landings data in order to create a combined fisheries landings dataset	Alaska Department of Fish and Game. Commercial Statistical Areas. https://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercialByFishery.statmaps Date Accessed: 2024-06-04.
ADFG survey geoduck beds	0.3	0		Alaska Department of Fish and Game, 2024. Geoduck Survey Beds through 2024 (Unpublished shapefile). Available from the author upon request. Date Acquired: 2024-06-04.
Alaska area plans	0.5	0	Filtered to only include areas that mention sport fishing	Alaska Department of Natural Resources - Information Resource Management, 2020: Area and Management Plan Boundary. https://data-soa-dnr.opendata.arcgis.com/datasets/99120ebf1efc40e4a4774eca6fb00c7a_19/about Date Accessed: 2024-06-15.

Table A-4. Industry, transportation, navigation submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
AIS vessel traffic	Continuous	0	Original AIS data was sent as unjoined vessel traffic lines; a script was run to join vessel transects into continuous transects. Vessel effort was then calculated on a continuous grid to get vessel density by month.	Marine Exchange of Alaska, 2012-2024: Automatic Identification System (AIS) Vessel Traffic. Marine Exchange of Alaska (Contact provider for access), https://www.mxak.org/services/maritime-domain-management/historicaldata/ Date Accessed: 2024-02-06.
Permitted log transfer facilities	0.2	500		Alaska Division of Forestry and Fire Protection, 2021 February 25: Permitted Log Transfer Facilities Public View. Alaska Department of Natural Resources, https://statewide-geoportal-1-soa-dnr.hub.arcgis.com/datasets/SOA-DNR::permitted-log-transfer-facilities-public-view/about Date Accessed: 2024-05-20.
Harbors	0.5	500		Alaska Department of Transportation and Public Facilities (ADOTPF), 2024: Harbors. ADOTPF, https://gis.data.alaska.gov/pages/9f00b292e3154ab2a4b62384e727ab07 Date Accessed: 2024-09-24.
US wave dataset	<= 1m: 0.8 <=1.5m: 0.5 <=2m: 0.3	0	Extracted average wave height from national dataset	Department of Energy's (DOE) Water Power Technology Office's (WPTO), 1979-2010: US Wave dataset, DOE WPTO, https://registry.opendata.aws/wpto-pds-us-wave/ Date Accessed: 2024-11.
ShoreZone mapping	very exposed: 0.3 exposed: 0.5 semi-exposed: 0.8	0	Extracted shoreline exposure sub layers from full shorezone dataset	Sarah Cook, Sean Daley, Kalen Morrow and Sheri Ward, Coastal and Ocean Resources, Victoria, B.C., Canada. 2017. ShoreZone Coastal Imaging and Habitat Mapping Protocol. NOAA National Marine Fisheries Service, https://www.fisheries.noaa.gov/alaska/habitat-conservation/alaska-shorezone Date Accessed: 2024-09-24.

Dataset name	Score	Buffer (m)	Processing description	Citation
Alaska area plans	0.5	0	Filtered to only include locations mentioning anchorages and species management	Alaska Department of Natural Resources - Information Resource Management, 2020, Area and Management Plan Boundary. Online linkage: https://data-soa-dnr.opendata.arcgis.com/datasets Date Accessed 2024-09-24.
Land permit or lease	0.5	0		Alaska Department of Natural Resources (DNR) GIS Public Access Coordinator, 2022: Land Permit or Lease - Polygon. Alaska DNR, https://data-soa-dnr.opendata.arcgis.com/maps/SOA-DNR::land-permit-or-lease/explore Date Accessed 2024-09-24.

Table A-5. National security submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
Formerly used defense sites	0.5	0		NOAA Office for Coastal Management, 2023. Formerly Used Defense Sits. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/54409 Date Accessed: 2024-09-24.
Munitions and explosives of concern	0.5	0		Office for Coastal Management (2024). Munitions and Explosives of Concern from 2023. NOAA National Centers for Environmental Information, https://www.fisheries.noaa.gov/inport/item/69013 Date Accessed: 2024-09-24.

Table A-6. Natural resources submodel data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
ShoreZone mapping	0.1 for overlap with NWI; 0.5 for everything else	0	Extracted only eelgrass sub layer	Sarah Cook, Sean Daley, Kalen Morrow and Sheri Ward Coastal and Ocean Resources, Victoria, B.C., Canada. 2017. ShoreZone Coastal Imaging and Habitat Mapping Protocol. NOAA National Marine Fisheries Service, https://www.fisheries.noaa.gov/alaska/habitat-conservation/alaska-shorezone Date Accessed: 2024-09-24.
Steller's eider molting areas	0.5	0	Extracted to only include colonies of sizes greater than 126	Larned WW, PD Anderson, R Corcoran. 2010. Distribution and abundance of Steller's eiders (*Polysticta stelleri*) in the Kodiak Archipelago, Alaska, February 2010. Unpublished report, US Fish and Wildlife Service, Alaska Region (OR: Waterfowl Management, Kodiak NWR), Anchorage, Alaska.
Steller sea lion haulouts and rookeries	Continuous	Refer to notes	Specific scoring of SSL haulouts and rookeries were specified in a PRD memo. Both categorical and continuous scoring were used out of a specified distance from haulouts and rookeries.	Protected Resources Division, NOAA Fisheries, Alaska Region (AKR). 2024. Stellar Sea Lion Major Haulouts and Rookeries. AKR Protected Resources Division (PRD) Data Layers and Scoring for Aquaculture Opportunity Atlas (Atlas). NOAA Technical Memorandum, U.S. Department of Commerce. Juneau (AK).
Essential Fish Habitat (EFH)	Combined EFH layer: 25th percentile:0.6 50th percentile:0.7 75th percentile:0.8 95th percentile :0.9	0		Pirtle, J. L., Laman, E. A., Harris, J., Siple, M. C., Rooper, C. N., Hurst, T. P., Conrath, C. L., and Gibson, G. A. 2023. Advancing model-based essential fish habitat descriptions for North Pacific species in the Gulf of Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-468, 541 p. DOI : https://doi.org/10.25923/ygdf-5f65.

Dataset name	Score	Buffer (m)	Processing description	Citation
North Pacific seabird data	0.8	0	USFWS guidance documentation outlined seabird colonies of significance, which was used to filter the data and extract colonies that met specific criteria.	Seabird Information Network, 2024. North Pacific Seabird Data Portal, http://axiom.seabirds.net/maps/north-pacific-seabirds/ Consulted on Oct 2, 2024.
Northern sea otter abundance and distribution on the Kodiak Archipelago	Continuous with range of 0.5-1	0	Applied a kernel density estimate function to the data to estimate sea otter hotspots	Cobb M. 2018. Northern sea otter (*Enhydra lutris*) Abundance and distribution on the Kodiak Archipelago. Refuge Report 2018.2, Kodiak National Wildlife Refuge, U.S. Fish and Wildlife Service, Kodiak, AK. Date Accessed: 2024-06-25.
Abundance and distribution of sea otters (*Enhydra lutris)* in the Southcentral Alaska stock, 2014, 2017, and 2019	Continuous with range of 0.5-1	0	Applied a kernel density estimate function to the data to estimate sea otter hotspots	Esslinger, G.G., Robinson, B.H., Monson, D.H., Taylor, R.L., Esler, D., Weitzman, B.P., and Garlich-Miller, J., 2021, Abundance and distribution of sea otters (*Enhydra lutris*) in the southcentral Alaska stock, 2014, 2017, and 2019: U.S. Geological Survey Open-File Report 2021–1122, 19 p., https://doi.org/10.3133/ofr20211122 Date Accessed: 2024-06-25.
Northern sea otter (*Enhydra lutris kenyoni*) population abundance and distribution across the Southeast Alaska stock summer 2022	Continuous with range of 0.5-1	0		Schuette, P., Eisaguirre, J., Weitzman, B., Power, C., Wetherington, E., Cate, J., Womble, J., Pearson, L., Melody, D., Merriman, C., Hanks, K., Esslinger, G. 2023. Northern Sea Otter (*Enhydra lutris kenyoni*) Population Abundance and Distribution across the Southeast Alaska Stock Summer 2022. USFWS Region 7 Technical Report MMM 2023-01, U.S. Fish and Wildlife Service, Alaska Region Headquarters, Anchorage, AK. https://www.fws.gov/media/usfws-region-7-technical-report-mmm-2023-01-march-2023 Date Accessed: 2024-06-25.

Dataset name	Score	Buffer (m)	Processing description	Citation
Alaska National Parks, preserves, monuments	0.5	0		Alaska Department of Environmental Conservation (DEC), 2020 December 2: Alaska National Parks, Preserves, Monuments. Alaska DEC, https://gis.data.alaska.gov/datasets/ADEC::alaska-national-parks-preserves-monuments/about Date Accessed: 2024-09-24.
Feeding BIAs	Combined protected species layer; Fin Whale: 0.2 Gray Whale: 0.8 NPRW: 0.1	0		Wild LA, Riley HE, Pearson HC, Gabriele CM, Neilson JL, Szabo A, Moran J, Straley JM and DeLand S. 2023. Biologically Important Area II for cetaceans within U.S. and adjacent waters - Gulf of Alaska Region. Front. Mar. Sci. 10:1134085. doi: 10.3389/fmars.2023.1134085.
ADF&G Southeast Alaska herring surveys	Continuous with range of 0.5-1	0	A 100m buffer was applied to survey line data, and then divided number of occurrences per relative ten year period to get an occurrences per year layer	Alaska Department of Fish and Game (ADF&G), 2020-2024. Southeast Alaska Herring Surveys. ADF&G, https://services.arcgis.com/VdkVOAHovLuozJG4/arcgis/rest/services/CF_Southeast_AK_HerringSurveys_Public_View/FeatureServer/2 Date Accessed: 2024-06-25.
Pacific herring spawning areas	0.5	0		NOAA Office of Response and Restoration (ORR), 1997-2023: Download ESI Maps and GIS Data - Pacific Herring Spawning Areas (for Kodiak and Seward). NOAA ORR, https://response.restoration.noaa.gov/esi_download Date Accessed: 2024-06-25.
Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska	Continuous with range of 0.5-1	0	Divided number of occurrences per relative ten year period to get an occurrences per year layer	Morella, J 2023. Aerial survey observations of Pacific herring spawn in Prince William Sound, Alaska, 1973-2021. Dataset. 10.24431/rw1k440, 10.24431/rw1k441. Date Accessed: 2024-06-25.

Table A-7. Classification and precision siting data inventory table.

Dataset name	Score	Buffer (m)	Processing description	Citation
Bathymetry (mhw, mllw)	Continuous	NA	Multiple bathymetric datasets were mosaiced and the resolution smoothed to create one single bathymetric grid over the entire study region. This rescaled dataset was also shifted in order to create depth datasets at different tide datums. ArcPRO slope geoprocessing tool was used to generate a slope raster of the study region. Min/mean/max depth and slope were extracted for each feature of the precision siting analysis.	NOAA National Geophysical Data Center, 2010: Southeast Alaska 8/3 arc-second MHHW Coastal Digital Elevation Model. NOAA National Centers for Environmental Information. https://www.ncei.noaa.gov/metadata/geoportal/rest/metadata/item/gov.noaa.ngdc.mgg.dem:715/html# Date Accessed: 2024-06-11. Alaska Fisheries Science Center, 2025: AFSC/RACE/GAP/Zimmermann: Central Gulf of Alaska Grid. NOAA National Centers for Environmental Information, https://www.fisheries.noaa.gov/inport/item/22897. Date Accessed: 2024-06-11 National Ocean Services, 2024: NOAA Center for Operational Oceanographic Products and Services (CO-OPS). CO-OPS, https://tidesandcurrents.noaa.gov/. Date Accessed: 2024-06-11
Harbors	Continuous	NA	Filtered to include Old Harbor and Larsen Bay harbor. Minimum distance was calculated from each point to each polygon represented in the precision siting analysis.	Alaska Department of Transportation and Public Facilities (ADOTPF), 2024: Harbors. ADOTPF, https://gis.data.alaska.gov/pages/9f00b292e3154ab2a4b62384e727ab07. Date Accessed: 2024-09-24.
Coastal populated places (cpp)	Continuous	NA	Filtered to include any place which has at least one thousand residents. Minimum distance was calculated from each point to each polygon represented in the precision siting analysis.	NOAA Office for Coastal Management, 2024: Coastal Populated Places. MarineCadastre.gov, https://www.fisheries.noaa.gov/inport/item/66114. Date Accessed: 2023-12-05.