

Figure 1: Vicinity map¹

Location: Northwest of Glidden Ledge, Western Shore of the Damariscotta River, Edgecomb, Lincoln County, Maine

Purpose: Experimental lease for the suspended and bottom culture of American/eastern oysters (*Crassostrea virginica*), European oysters (*Ostrea edulis*), hard clams (*Mercenaria mercenaria*), and bay scallops (*Argopecten irradians*)

Site Review by: Flora Drury and Cheyenne Adams

Report Preparation by: Cheyenne Adams, Flora Drury, and Marcy Nelson

Report Completed: January 27, 2022

¹All figures in this report were created in ArcMap version 10.6 using digitized NOAA Nautical Charts or geo-referenced aerial photographs provided by The Maine Office of GIS (*orthoCoastalCentralCoast2003and2005*).

Application Overview

The applicant is requesting 3.94² acres in the Damariscotta River for the suspended and bottom culture of American/eastern oysters (*Crassostrea virginica*), European oysters (*Ostrea edulis*), hard clams (*Mercenaria mercenaria*) and bay scallops (*Argopecten irradians*).³ The proposed lease footprint is divided into three distinct areas, plus a 104-foot wide navigation lane leading to the applicant's dock. Approximately 0.92 acres on the southern end of site are proposed for bottom planting and drag harvesting of oysters.⁴ Nine storage rafts (25' x 20' x 46") and 107 bottom cages (50" x 50" x 45") are being proposed for the northeastern ~2.10 acres, which is referred to in the application as the "Pen Area." Each bottom cage would contain up to 40 trays (24" x 24" x 4") and be marked with an individual toggle buoy. The northwestern ~0.46 acres (referred to in the application as the "nearshore area") are being requested for 20 longlines holding either 750 Zapco tubes (13" x 35") or 850 soft mesh bags (21" x 28" x 5"), referred to as "flip bags" in the application); the longlines would be arranged in five sets of four running approximately east to west. The remainder of the requested acreage is composed of the navigation lane.⁵

General Characteristics

On September 17, 2021, Maine Department of Marine Resources (MDMR) staff Flora Drury and Cheyenne Adams visited the proposed experimental aquaculture lease. MDMR staff arrived in the vicinity at approximately 2:35 pm; the tide was ebbing. The proposed lease occupies subtidal waters northwest of Glidden Ledge, along the western shore of the Damariscotta River, in the Town of Edgecomb (Figure 1 & Images 1-5). The adjacent shoreline is rocky and leads to forested uplands and the applicant's commercial facility. Shorelines in the general vicinity, on both the western and eastern side of the river, exhibit scattered residential houses and docks.

² The application requests 3.93 acres, but DMR calculations, based on the application coordinates, indicates that the area is 3.94 acres.

³ Application, pages 1-2

⁴ The application depicts the bottom plant area as 230' x 195' on page 14. However, this is a measurement error and, in order to maintain a 104-foot wide navigation lane, the bottom plant area would be approximately 200' x 195' and 0.92 acres. (Email from Jess Auger to C. Adams on 11/08/2021)

⁵ Application page 14-19 and 23; measurements made with the ArcMap 10.6 measuring tool from distances provided on page 14



Image 1: Facing northwest toward the western shoreline of the Damariscotta River and the applicant’s aquaculture gear⁶ from near the center of the proposed lease site (September 17, 2021).



Image 2: Facing north toward the western shoreline of the Damariscotta River and the applicant’s floating rafts from near the center of the proposed lease site (September 17, 2021).

⁶ The observed aquaculture gear was unpermitted. However, at the time this report was written all unpermitted gear had been removed.



Image 3: Facing northeast toward the head of the Damariscotta River and the applicant's floating rafts from near the center of the proposed lease site (September 17, 2021).



Image 4: Facing east toward the eastern shoreline of the Damariscotta River and the applicant's moored vessels from near the center of the proposed lease site (September 17, 2021).



Image 5: Facing south toward the applicant’s dock from near the center of the proposed lease site (September 17, 2021).



Image 6: Facing southwest and toward the applicant’s processing facility from near the center of the proposed lease site (September 17, 2021).

Depth

MDMR staff measured depths at the proposed lease corners at approximately 2:35 pm on September 17, 2021 and 10:20 am on December 1, 2021 using a transom-mounted depth sounder. Table 1 lists tide information for both days. At the time of MDMR's site assessment on September 17, measured water depths ranged from approximately 9.1 to 26.8 feet at the proposed corners A, B, C, D, E, F and L. At the time of MDMR's site assessment on December 1, measured water depths ranged from approximately 7.2 to 9.3 feet at the proposed corners G, H, I, J, and K. Correcting for tidal variation derives water depths approximately 0.5 feet and 6.9 feet lower and mean low water (MLW, 0.0 feet) for September 17 and December 1, respectively. Overall, depths at the proposed corners range from 0.26 feet to 26.3 feet at MLW.

Due to the proposed lease area partially overlapping with intertidal land as indicated on available NOAA nautical charts, the applicant submitted evidence that the proposal is located below mean low water. This evidence is composed of photos of the water line taken at or below 0.0' tidal height at the proposed corners I, J, and K which demonstrated that those locations are subtidal.⁷

Table 1. Tide predictions at Newcastle, Damariscotta River, Maine (44° 2.0' N, 69° 32.2' W).⁸

Date	Time	Height (ft)
09/17/2021	9:10 AM	9.0 H
09/17/2021	3:16 PM	0.9 L
09/17/2021	9:26 PM	10.3 H
12/01/2021	1:56 AM	0.16 L
12/01/2021	8:04 AM	10.34 H
12/01/2021	2:32 PM	-0.26 L

Bottom Characteristics

MDMR staff observed the bottom characteristics of the proposed lease site via three drop-camera transects on December 01, 2021 (Figure 2). Bottom characteristics were categorized using the Coastal and Marine Ecological Classification Standard (CMECS), a national standard for describing features of the marine environment (Table 2). Sediment information was determined based on visual analysis of the video; no sediment samples were collected, or grain size analysis performed. Mud composed most of the proposed lease bottom covered in the dive transect, and live American Oyster (*C. virginica*) shell rubble was present largely in the southeastern section of the lease near the proposed A-B boundary (Image 7).

⁷ Subtidal proof for corners I and J is included in the application; proof for corner K was emailed to C. Adams and saved to the case file on 11/04/2021.

⁸ <https://tidesandcurrents.noaa.gov/>

Table 2. Bottom characteristics of proposed site

Substrate Origin	Substrate Class	Substrate Subclass	Substrate Group
Geologic Substrate	Unconsolidated Mineral Substrate	Fine Unconsolidated Substrate	Mud
Geologic Substrate	Unconsolidated Mineral Substrate	Course Unconsolidated Substrate	Boulder
Biogenic Substrate	Shell Substrate	Shell Rubble	Oyster

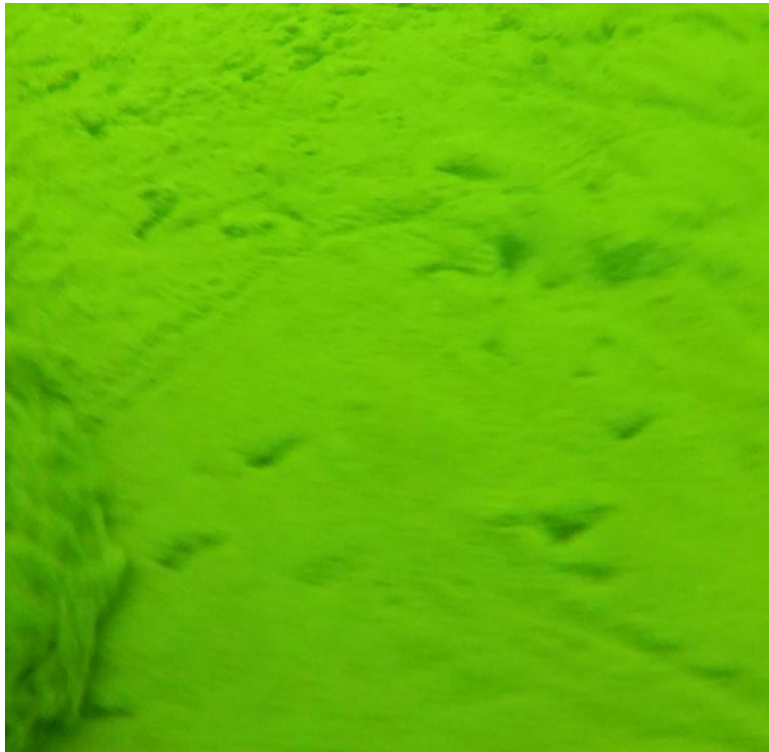


Image 7: Mud observed on bottom of proposed lease site during drop-camera transect conducted on December 01, 2021.

Position and Distances to Shore

The coordinate geometry (COGO) report and measuring tools in ArcMap 10.6 were used to verify the distances and bearings between proposed lease corners. Distances to shore were determined using the measuring tool in ArcMap 10.6, digital orthophotography provided by the Maine Office of GIS, and the application coordinates.

Coordinates (WGS84) – 3.94 acres (Figure 2)

<u>Corner</u>	<u>Latitude</u>	<u>Longitude</u>	
A	43° 58' 27.33" N	69° 34' 19.73" W	then 195.92 feet at 63.02° True to
B	43° 58' 28.22" N	69° 34' 17.35" W	then 303.91 feet at 331.96° True to
C	43° 58' 30.86" N	69° 34' 19.33" W	then 180.31 feet at 67.96° True to
D	43° 58' 31.54" N	69° 34' 17.05" W	then 133.91 feet at 334.51° True to
E	43° 58' 32.73" N	69° 34' 17.85" W	then 420.37 feet at 271.23° True to
F	43° 58' 32.79" N	69° 34' 23.60" W	then 289.36 feet at 259.71° True to
G	43° 58' 32.26" N	69° 34' 27.49" W	then 45.93 feet at 140.88° True to
H	43° 58' 31.91" N	69° 34' 27.09" W	then 61.40 feet at 105.69° True to
I	43° 58' 31.75" N	69° 34' 26.28" W	then 99.02 feet at 124.62° True to
J	43° 58' 31.20" N	69° 34' 25.16" W	then 81.81 feet at 70.72° True to
K	43° 58' 31.48" N	69° 34' 24.11" W	then 95.97 feet at 75.72° True to
L	43° 58' 31.72" N	69° 34' 22.84" W	then 499.16 feet at 152.15° True to A.

Table 3. Approximate distances from the proposed lease to surrounding features (Figures 1 & 2). Measurements were made using digital orthophotography provided by the Maine office of GIS (*orthoCoastalCentralCoast2003and2005*) and NOAA Nautical Charts.

Feature	Distance
E-F Boundary to rocks surrounding unnamed island, Nearest Point (~MLW)	~980 feet to the north
Corner A to Nearest Point, dock owned by Tonie Simmons, Nearest Point	~20 feet southwest
Corner K to Nearest Point, rocky shoreline of Damariscotta River	~15 feet southeast
Corner G to Nearest Point, rocky shoreline of Damariscotta River	~80 feet southwest
Corner F to Nearest Point to the north, rocky shoreline of Damariscotta River	~355 feet to the northwest
Corner D to 63-foot contour line (NOAA Chart)	~55 feet to the east
F-G Boundary to dock owned by Barbara Scully, Nearest Point	~390 feet to the north

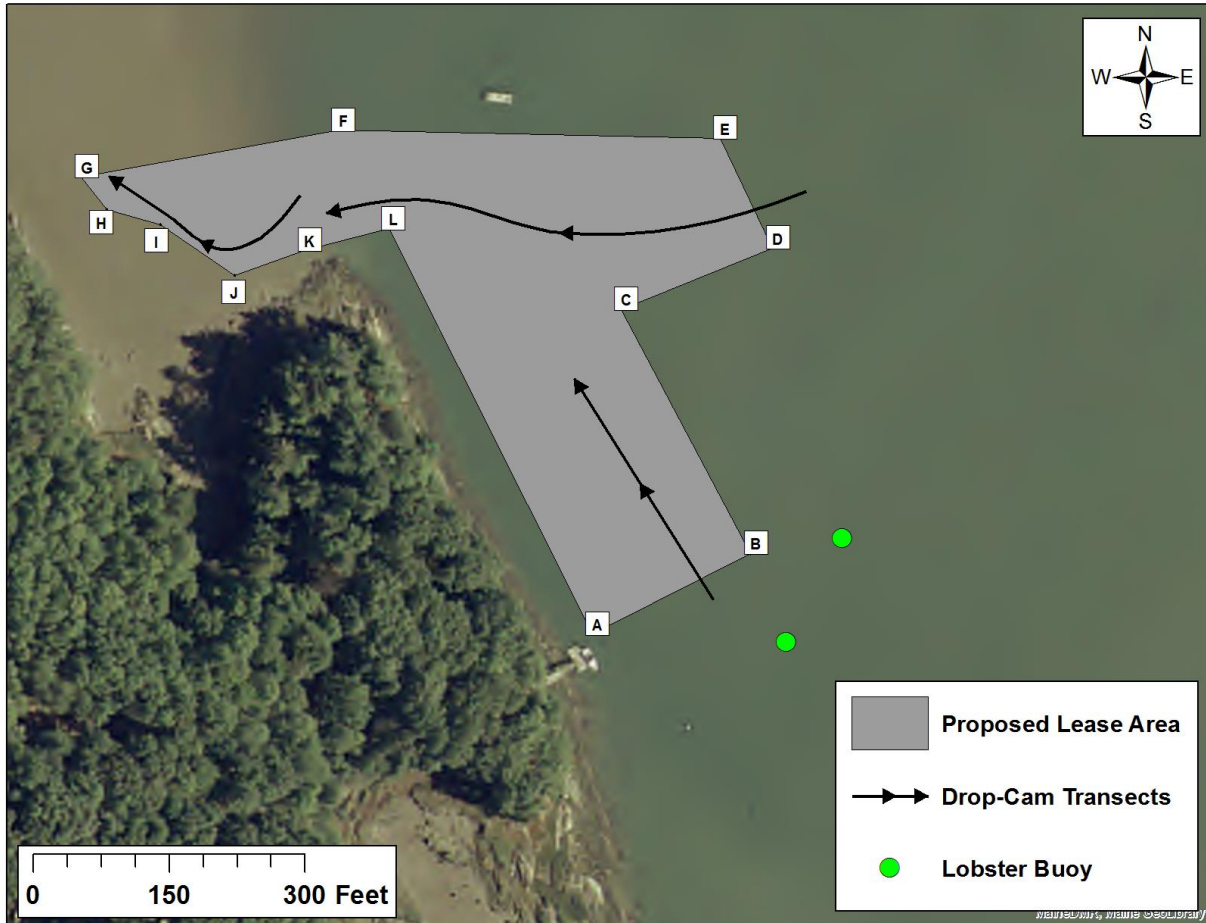


Figure 2: Lobster buoys located nearest to the proposed lease site on September 17, 2021 and drop camera transect conducted December 01, 2021.

The criteria MDMR uses to determine the suitability of an experimental aquaculture operation to a particular area (MDMR Regulations Chapter 2.64(11)(A)) are discussed, with respect to the proposal, below:

(1) Riparian Owners Ingress and Egress

The proposed lease is located along the western shoreline of the Damariscotta River, adjacent to the applicant’s upland facility. The proposed lease footprint encompasses the applicant’s dock and several storage floats and vessel moorings. Additionally, the dock outside of the proposal area, approximately 20 feet southwest of Corner A, is owned by Tonie Simmons, who is an employee of Muscongus Bay Aquaculture, LLC and listed as the contact person on the lease application.⁹ No negative impact to the use of these structures is expected if the proposal were to be granted, since they are all associated with the applicant.

The nearest dock not associated with the proposal, according to the application, is approximately 400 feet to the north of the proposed F-G boundary. Other nearby structures listed in the application

⁹ Application, pages 4 and 9

include a mooring and two storage rafts, approximately 270, 286, and 370 feet to the north of the proposed E-F boundary, respectively.¹⁰ The distance between the proposal and dock is likely sufficient to allow for unimpeded access. Depending on the direction of travel, a riparian vessel may need to alter their route slightly to avoid the “Pen Area” of the proposal, but this is unlikely to be an undue burden. Likewise, access to the mooring and/or rafts to the immediate north of the proposal is unlikely to be hindered significantly if the proposed lease were to be granted, but traditional access routes, especially from the south, may require a small adjustment to avoid the “Pen Area.” Additionally, considering the mean low water depth of 17 feet¹¹ at said mooring, it is unlikely that any scope of mooring line would cause a moored vessel to drift into the proposed lease area.

The “Nearshore Area” that is proposed to host Zapco tubes and flip bags would be located adjacent to upland property (Edgecomb Map 06, Lot 054-01, labelled as R06-054-01 in Figure 3) that does not appear to be associated with the applicant (Figure 3). Although there are currently no docks or other structures at this property, the presence of surface gear secured with posts installed in the mud would likely inhibit access to at least 200 feet of the ~400 feet of shoreline for that parcel. Furthermore, the presence of aquaculture gear at this location may hinder the ability of the aforementioned landowner to construct a dock, if they wish to do so in the future. According to information submitted by this riparian landowner during the comment period for the proposed lease application, this landowner has acquired a feasibility assessment for the potential construction of a dock. The construction location of said dock, as approximated visually from the feasibility assessment submitted by the riparian landowner, is included in Figure 3. According to a diagram included in the feasibility assessment, the dock would extend slightly over 132 feet from the high tide waterline. Based on visual approximation of the dock construction location, the nearest proposed aquaculture gear would be approximately 110 feet to the southeast.

Additionally, though no comments were received by MDMR, traditional access routes to Edgecomb Map 06 Lot 56-2 may be altered by the presence of the proposed aquaculture gear, if the lease is granted. The proposal is unlikely to prevent ingress and egress abilities to this shorefront property, however.

During MDMR’s site assessment on September 17, 2021, additional docks were observed along both the eastern and western shoreline of the Damariscotta River. Due to significant distances between them and the proposal, it is unlikely these docks would be impacted by the granting of the proposed lease.

¹⁰ Application, page 4

¹¹ NOAA Nautical Chart

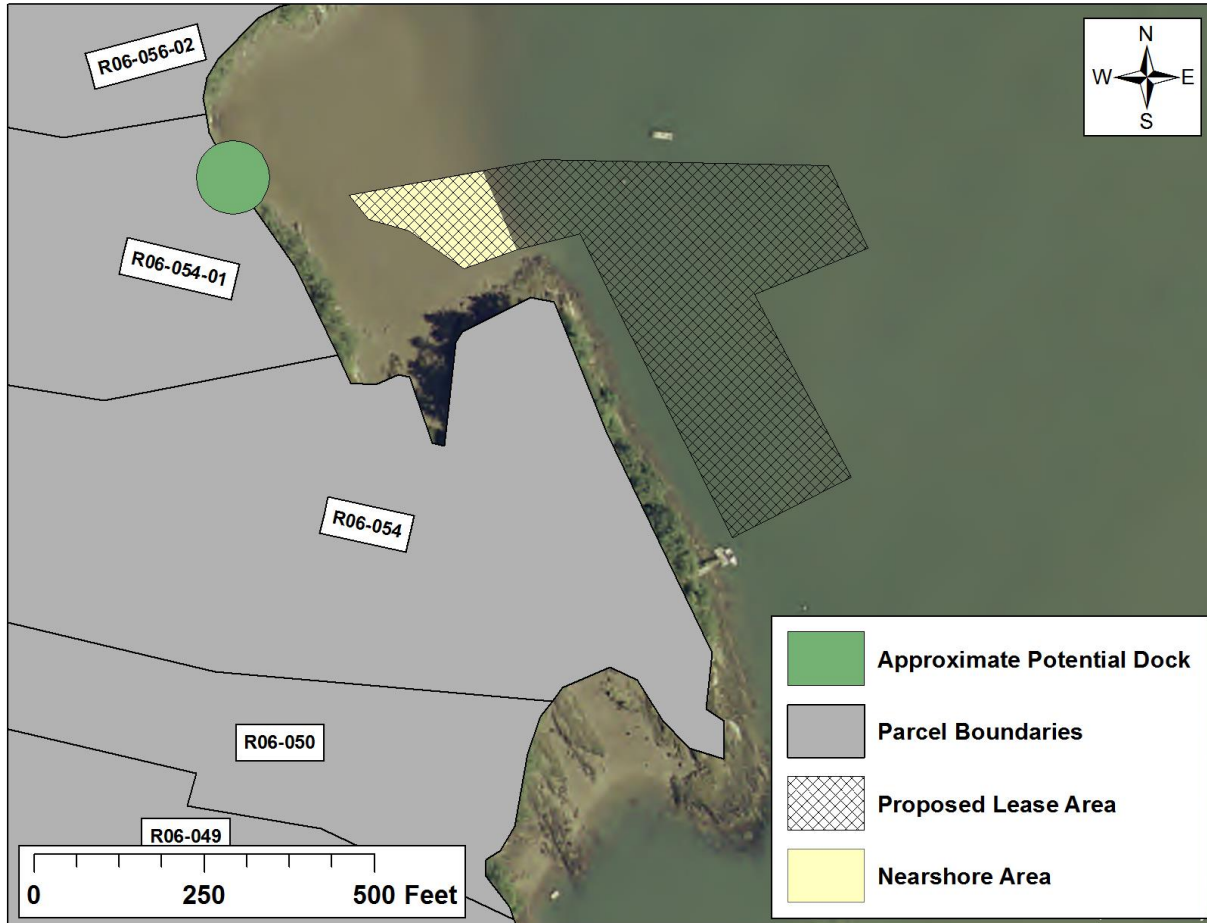


Figure 3: Approximate parcel boundaries and potential dock construction site near the proposed lease area.

(2) Navigation

The proposal is 55 feet to the west of the 63-foot contour line associated with the marked navigation channel at the nearest point, as indicated on available NOAA charts. Although the Damariscotta River experiences heavy commercial and recreational traffic, especially during the summer months, the location of the proposed lease should not interfere with the main vessel flow in the area due to being located entirely outside the marked channel. The proposal is located at the lower/southern end of Lower Dodge Cove, adjacent to the applicant’s upland facility, hence most mariners entering the cove are unlikely to have destinations that would require transiting through the proposed lease footprint. A potential exception to this is access to and from Lot R06-54-01, which is discussed in “Section 1: Riparian Owners Ingress and Egress.”

(3) Fishing and Water-Related Uses

During MDMR’s site assessment on September 17, 2021, approximately 8 lobster trap buoys were observed near the proposed lease area, with additional moderate lobstering activity in the channel to the east of the proposal. The nearest two lobster trap buoys were approximately 100 feet to the east and southeast of Corner B (Figure 2). Although the nearshore American lobster

(*Homarus americanus*) fishery in Maine is seasonal, following the migration and molt cycle of lobsters, lobster fishing seemed to be present in the general vicinity at the time of MDMR's visit and no lobster trap buoys were noted within the proposed lease boundaries.

The "Nearshore Area" that would host Zapco tubes and flip bags, if the proposed lease were granted, is very shallow and likely drains during negative tides. A comment submitted by the MDMR Area Biologist stated that they had no concerns about wild shellfish harvesting in the proposed lease area.¹²

No recreational fishing was observed during MDMR's site assessment on September 17, 2021, and the site does not exhibit distinct topographical features that make it a likely attraction to hook and line fishermen. According to MDMR's Recreational Fishing Program, striped bass fishing occurs in the Damariscotta River and is often conducted close to shore, in waters less than 20 feet deep.¹³ However, hook and line fishing may be able to occur in at least some areas of the proposal, if it were granted, such as the area proposed for bottom planting.

(4) Other Aquaculture Uses

At the time of this report, there were 4 Limited Purpose Aquaculture (LPA) licenses and one aquaculture lease within 1,000 feet of the proposal (Figure 4). The closest aquaculture site to the proposal is LPA license BSCU318, which is located approximately 345 feet to the north and is approved for the bottom and suspended culture of shellfish. Dodge Cove Marine Farm, LLC, a sister company of the applicant, has a pending standard lease application in Upper Dodge Cove that was received prior to the application under consideration in this report.

The application included a note on page 57 detailing concerns from Barbara Scully, the license holder of BSCU318 and two other nearby LPA licenses, about the proposed lease increasing siltation that she is currently experiencing at her dock and LPA sites. The note goes on to state that the applicant has "significantly scaled back the amount of gear requested" in response to Ms. Scully's concerns, and included reference to a scientific publication which reports minimal, short-term effects of drag harvesting. Another section of the same publication, specifically related to sediment resuspension impacts of cultured shellfish drag harvesting, states that "most of the larger particles settle almost immediately, but fine silt can remain suspended for days. Most studies show that over 95% of the sediment sinks to the bottom within a few tens of meters of the source" The nearest LPA and Ms. Scully's dock are approximately 810 and 840 feet to the north, respectively, of the area that is proposed for drag harvest. However, the publication also states that "the observed effects are site specific as a consequence of sediment grain size and type and hydrological conditions."¹⁴

Additionally, a NOAA Technical Memorandum on the ecological effects of drag harvesting cultured shellfish states the following, in regard to resuspended sediment plumes:

¹² Email from A. Leach dated 11/15/2021

¹³ Email conversation between F. Drury and members of MDMR's Recreational Fishing Program (C. Ura-neck and C. Brown) on March 30, 2020.

¹⁴ Stokesbury, Kevin D.E., Baker, Edward P., Harris, Bradley P., and Rheault, Robert B. Environmental Impacts Related to Mechanical Harvest of Cultured Shellfish, *Shellfish Aquaculture and the Environment*, First Edition. Edited by Sandra E. Shumway. 2011

Larger sand particles are redeposited near the [drag] while measurable amounts of fine silt and clay particles remain in suspension and may be carried away by currents (Godcharles 1971; Tuck et al. 2000). Sediment grain size, wave activity, current levels, and water column depth all determine the initial turbidity, light attenuation, size, and dissolution of [drag] plumes (Ruffin 1995; Tarnowski 2006). Substrate type can determine the amount of suspended solids in a plume and how long it persists, while the distance and direction of the plume is primarily controlled by water currents (Tarnowski 2006). The volume of displaced sediment determines the concentration of suspended particles. Mechanized harvesting can increase siltation at lower depths (Rothschild et al. 1994; Breitburg et al. 2000; Street et al. 2005) by winnowing of fine sediments by strong currents and wave action (Cranfield et al. 1999). The largest plumes, highest turbidity, greatest light attenuation levels, and slowest plume decay rates are generally produced in shallow water environments containing high silt and clay content (Ruffin 1995; Tarnowski 2006). Suspension and redistribution of sediments from dredging can impact organisms living some distance away from the harvested area (Kyte and Chew 1975).¹⁵

While the general conclusion of much of the referenced scientific literature is that the effects of drag harvesting are typically minimal, localized, and with quick recovery rates, the potential appears to exist for increases in siltation rates near the proposed drag site, depending in part on local sediment type and hydrodynamics. The sediment observed along the drop camera transect, including the area proposed for drag harvesting, conducted as part of MDMR's site assessment was visually characterized as mud. A geophysical survey of the Damariscotta River found substrate in Lower Dodge Cove to be largely composed of softer sediment, with firmer sediments in the areas closer to the main river channel and shore (Chandler 2016).¹⁶ Additionally, a hydrodynamic study of the general area documented the development of a counterclockwise gyre during flood tides north of the constriction at Glidden Ledge (Lieberthal et al. 2019, Glidden Ledge shown in Figure 4).¹⁷ During flood tides, the flow of the gyre results in landward/northward current directions in the main river channel and seaward/southward current directions in the shoal areas to the west of the main river channel, including Lower Dodge Cove. The gyre was observed to “spin down” and reverse directions during the end of the flood tide; seaward/southward flow was observed over the shoals during the ebb tide. Although the specific implications of this gyre and related local hydrodynamics to the fate of resuspended drag material from the proposed site has not been explicitly studied, drag harvesting may be less likely to increase siltation in Lower Dodge Cove if it were to occur during the ebb tidal stage when southward/seaward flow is observed at the site. Monitoring for increased siltation within the cove could corroborate the effectiveness of ebb tide dragging, if the lease is granted.

¹⁵ Mercaldo-Allen, Renee and Goldberg, Ronald. Review of the Ecological Effects of Dredging in the cultivation and Harvest of Molluscan Shellfish. NOAA Technical Memorandum NMFS-NE-220. December 2011.

¹⁶ Chandler, Emily A. (2016). Sediment accumulation patterns in the Damariscotta River Estuary (Master's Thesis). Orono ME: Department of Earth Sciences, University of Maine.

¹⁷ Lieberthal, B., Huguenard, K., Ross, L., & Bears, K. (2019). The generation of overtides in flow around a headland in a low inflow estuary. *Journal of Geophysical Research: Oceans*, 124, 955–980.

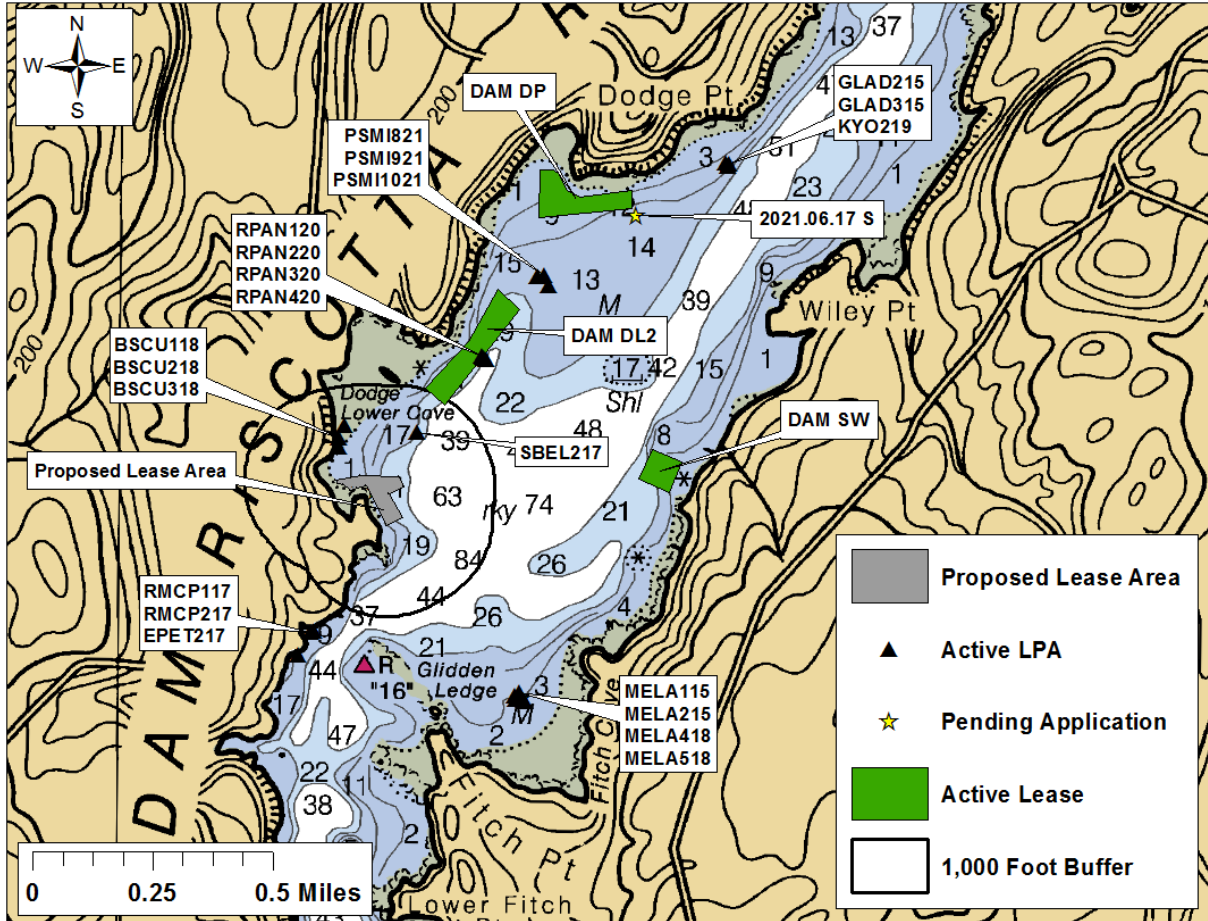


Figure 4: Active leases, Limited Purpose Aquaculture (LPA) licenses, and pending lease applications near the proposal.

(5) Existing System Support

Epibenthic Flora and Fauna

On December 01, 2021, MDMR staff conducted three drop camera transects within the proposed lease site to assess the epibenthic ecology of the area (Figure 2). The bottom of the proposed lease is composed primarily of mud (Image 7), with one section of live American oysters (*C. virginica*) near the proposed A-B boundary (Image 8). Epibenthic macro flora and fauna observed during the transects are described in Table 4.

Table 4. Species observed by MDMR drop-camera within the proposed lease site on December 01, 2021.

Species Observed	Abundance
American oyster (<i>Crassostrea virginica</i>)	Common in southeastern section of proposal near A-B boundary
Crab (<i>Cancer sp.</i>)	Rare
Colonial tunicate (possibly <i>Didemnum sp.</i>)	Rare



Image 8: American oyster (*C. virginica*) observed during dive transect conducted on December 01, 2021.

Wildlife

According to GIS (Geographic Information System) data maintained by the Maine Department of Inland Fisheries and Wildlife (MDIF&W) and available through the Maine Office of GIS, the proposed lease overlaps with Tidal Waterfowl and Wading Bird Habitat by approximately 15 feet (Figure 4). Tidal Waterfowl and Wading Bird Habitat is defined as Significant Wildlife Habitat by Maine’s Natural Resource Protection Act (Figure 5).

On October 8, 2021 a Wildlife Biologist at MDIF&W responded by email to a “Request for Agency Review and Comment”, stating “minimal impacts to wildlife are anticipated for . . . Muscongus Bay [Aquaculture, LLC]”.



Figure 5: Tidal Wading Bird and Waterfowl Habitat¹⁸ near the proposed lease site.

Eelgrass

Historical eelgrass (*Zostera marina*) data collected in 2005 by The Maine Department of Marine Resources indicate that the closest mapped eelgrass beds were located 1,490 feet to the southeast of the proposed lease (Figure 6). No evidence of eelgrass was observed in the drop camera transects conducted by MDMR on December 1, 2021.

¹⁸ Data obtained from MDIWF maintained SDE Feature Class "GISVIEW.MEIFW.Twwh"

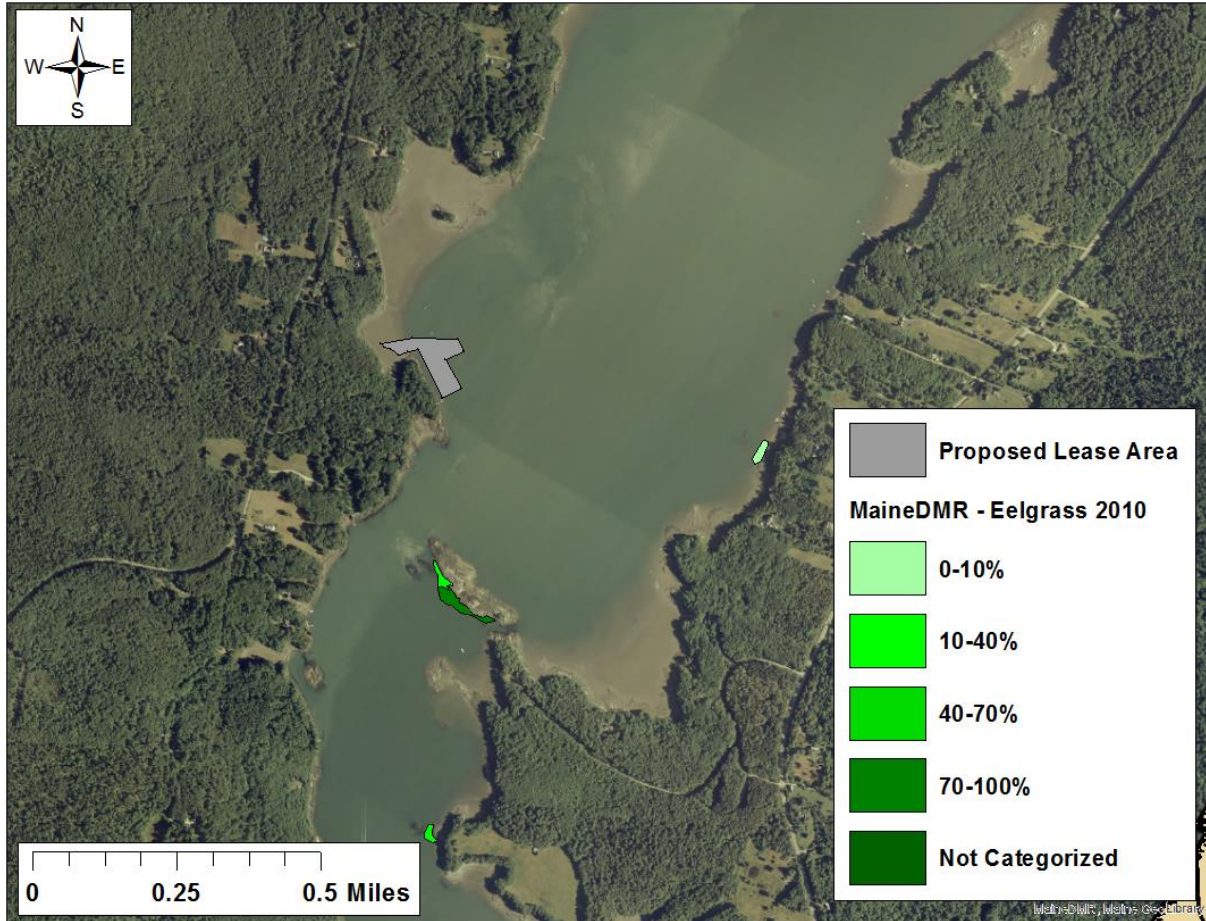


Figure 6: Historical eelgrass (*Z. marina*) in the vicinity of the proposed lease.¹⁹

(6) Source of Organisms to be Cultured

The application states that American/eastern oysters (*C. virginica*), European oysters (*O. edulis*), hard clams (*M. mercenaria*), and bay scallops (*A. irradians*) would be sourced from Muscongus Bay Aquaculture, which is an approved source by MDMR for these species.

(7) Interference with Public Facilities

There are no beaches, parks, or docking facilities owned by federal, state, or municipal government within 1,000 feet of the proposed lease site.

¹⁹ Data obtained from MDMR maintained SDE Feature Class "MaineDMR – Eelgrass 2010"