

Razor clam Report
Prepared for the Southeast Conference
Prepared by the Alutiiq Pride Marine Institute
Written by Jake Cohen, Research Biologist
September 30th, 2026

Purpose and Context

Pacific razor clams (*Siliqua patula*) are a historically important species in coastal Alaska, with significant commercial and subsistence harvests in Prince William Sound (PWS) and Cook Inlet (Bishop 2003, Booz 2025). In recent years, both stocks of razor clams have declined. The historic PWS commercial fishery, which peaked at 600,000 annual pounds harvested in Cordova, collapsed after the 1964 earthquake which damaged many clamming beaches (Bishop, 2003). More recently, reduction in habitat quality have closed the personal use fishery in Eastern Cook Inlet (Booz 2025). Clam Gulch has been closed to razor clam harvest since 2015. Ninilchik beach was open for one limited four-day season in 2023 but has otherwise been closed since 2015 (Booz 2025). Despite declining numbers, Pacific razor clams remain a valuable economic, subsistence, and cultural resource and there is significant interest in restoring this species to former habitat (Bishop 2003, Booz 2025).

The Alaska Mariculture Cluster, a grant administered by the Southeast Conference (SEC) as part of the Build Back Better Regional Challenge, provided seed money to fund research into the production of ‘other mariculture species’. Under a subaward from SEC, the Alutiiq Pride Marine Institute (APMI) was tasked with determining a protocol for the captive spawning and of razor clams. Under partnership with the Alaska Department of Fish and Game (ADFG), this captive stock would be released onto historically productive razor clam beaches to investigate the possibility of both mariculture of this species and outplanting of beaches to increase productivity and restore populations. Under agreement, APMI would undertake the following tasks in preparation for outplanting and reporting:

Task 1: Seedstock production and research

- *CRRC will begin a clam breeding program, trialing at least two hatchery methods in order to find the protocol that leads to greater survival rates of larval and juvenile razor clams.*
- *CRRC will identify field sites and identify optimal spawning times for broodstock.*

Task 2: Outplanting and Monitoring

- *CRRC will implement a calcein marking technique to differentiate hatchery-raised clams from wild clams.*
- *CRRC will release hatchery raised razor clams at beaches in Cook Inlet in 2025 and 2026.*
- *CRRC or partners will conduct abundance surveys at beaches where hatchery-*

raised, calcein-marked razor clams were stocked and beaches where clams were not stocked to track the success of restocking efforts, including survival rates, growth, and reproduction.

Task 3: Data analysis

- *CRRC will analyze data to determine the abundance of their hatchery-raised razor clams at field sites and measure the effectiveness of their out-planting methods.*
- *CRRC will determine which spawning methods lead to greatest survival.*
- *CRRC will determine how razor clam growth and survival vary by site.*

Activities and Outcomes

Season One: 2025-2026

ADFG Permit no. P-25-027

On March 17th 2025, Alutiiq Pride Marine Institute Director Jeff Hetrick and Mariculture Director Annette Jarosz met with Mike Booz, Lower Cook Inlet Area Manager with the Alaska Department of Fish and Game in Homer and reviewed the history of razor clam research on the Kenai Peninsula and survey techniques for this species. The personnel outlined a summer schedule for APMI team members to assist with sampling on Cook Inlet beaches led by ADFG on the East side of Cook Inlet, broodstock collection and scheduling, and review a study plan to be submitted to ADFG.

The approved Aquatic Research Permit included a study plan involving 10,000 juveniles for outstocking razor clams in 2026. APMI and ADFG would share in sampling and data collection. In April 2025 APMI set up broodstock holding systems and prepared the larvae rearing tanks.

On June 23, 2025, Jarosz and Hetrick chartered Bottomline Charters (Captain Eric Kirby) from Ninilchik to Crescent River and collected 150 adult razor clams out of 200 allowed by permit P-25-027. ADFG Biologist Mike Booz and staff were on the same trip and shared insights into clamming techniques and habitat observations. These clams were transported back to APMI and induced to spawn on June 25. The spawn was weak with and estimated 200,000 eggs released. By day three, 100,000 made the D-hinge stage which reflects a typical percent loss post-gamete release. The larvae stage lasted 22 days and the total estimated set was 25,500 in line with expected results.

Adult razor clams do not hold well, and by day eight, after daily challenging the brood with heavy food and increased temperature, all the brood had died. They were held at ambient temperature of 12 C.

A second shipment of broodstock to complete our permit allocation of 200 clams was collected on July 13th utilizing local charter operator Duke Air to fly to Crescent River. Poor sea conditions necessitated alternative transportation to access the clamming beaches. This brood had a small spawning event on July 14, however only 60,000 larvae survived until day eight.

They were eventually combined with the spawn that occurred the next day. On July 15th, a good spawn yielded 11 million eggs from 35 females and by day three 3.5 million D-hinge larvae. By August 16 (Day 22) at the settling stage, the population had reduced to 380,000. The adults were held in cooler water (7C) but still only lasted 10 days. These settled larvae were used for substrate size analysis.

The clams were settled in three substrate types: 1) “Large” #4095, 40 mesh, 400-600 microns 2) “Small” #4010, 40 mesh, 300-500 microns 3) “Extra Small” #7030, 30 mesh, 150-300 microns. The Large substrate yielded the best results. This sand proved to be too thick and heavy and restricted water flow.

The surviving clams were combined into one silo and were reared at 13.5 C with heavy feeding attempting to maintain a 50,000 cells/mL of feed algae. By September of spawning year clams reached 2mm. Several months after spawning, by 2/15/2026, only 320 Razor clams remained.

Mortality increased throughout the hatchery rearing, with 39 juvenile clams alive on the day of outplanting. The largest juvenile clams were about 2 centimeters in length, with many smaller individuals also present and an average size at last measure of 1.395 cm in length. On 4/29/2026, the 39 remaining clams were transported to Ninilchik Beach on Eastern Cook Inlet at the morning low tide for outplanting. The outplanting coincided with a razor clam survey from the ADF&G Homer office. Some of the juvenile clams responded well to outplanting, working quickly to bury themselves. Those which did not bury themselves after about 10 minutes were manually covered with sand to prevent them from being washed away with the incoming low tide.



Razor clam outplanting in April 2026

The survey team from the ADF&G Homer office conducted a follow-up search for outplanted clams on 4/30/2026. They found 2 of the 39 outplanted juvenile clams stating, “*They both had pretty obvious, but tiny, shows in the sand. It was a terrible day to look for shows (overcast and lots of dimples on the beach from raindrops), so given their size and the fact that it’s hard to see shows from larger clams in those conditions, I was pretty happy with seeing 2!*” The ADF&G team followed up with a second search for outplanted clams in mid-June but saw no evidence of outplanted clams.

The overall survey conducted by ADF&G of Ninilchik beach estimated an abundance of 31,000 adult clams at Ninilchik, a number 85% below the limit needed to open the fishery. The razor clam sport fishery for East Cook Inlet remained closed for the 2026 season.

Season Two: 2026-2027

ADFG Permit no. P-26-029

We collected a second year of razor clam broodstock under this grant to improve upon previous protocols and assist ADFG partners with outplanting efforts. After the low yields resulting from the 2025-2026 broodstock, we hoped to improve success by keeping adult clams in a sand substrate to increase survival. We also planned to attempt strip-spawning of Razor clams to compare this method of captive spawning with natural induction. Lastly, we planned to calcein mark this batch of juvenile razor clams to allow for tracking after outplanting.

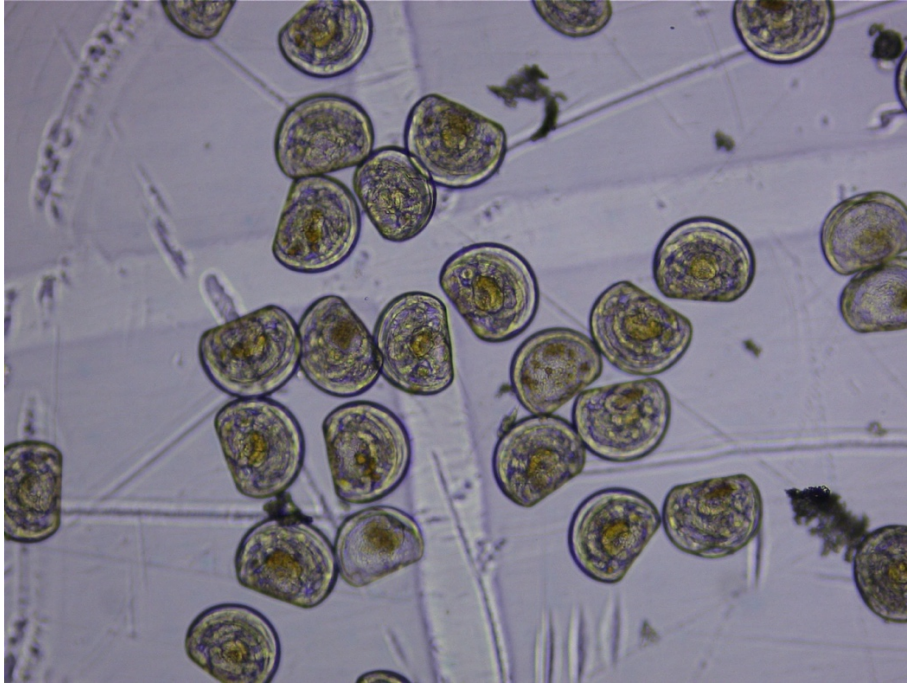
115 razor clams were collected by Bottomline Charters from Ninilchik on July 16th, 2026, and immediately driven to the APMI hatchery in Seward. The clams were constrained with rubber bands and hair ties to hold the shells in place and some were vertically buried in mud collected from west Cook Inlet. The following weekend, July 18-19, the razor clams spawned and fertilized eggs were collected and placed into a conical tank for pelagic larval growth. Initial estimates from this first spawning event was 1.9 million larvae after 1 week of in pelagic culture. Larvae in suspension were fed 25k t-iso algal culture and were monitored through the pelagic growth stage. By day 16, the end of the suspended larval phase, the larval count dropped to 263,000 which were settled into a grow out tank at about 10 degrees C.



Adult razor clams upon entering the hatchery.

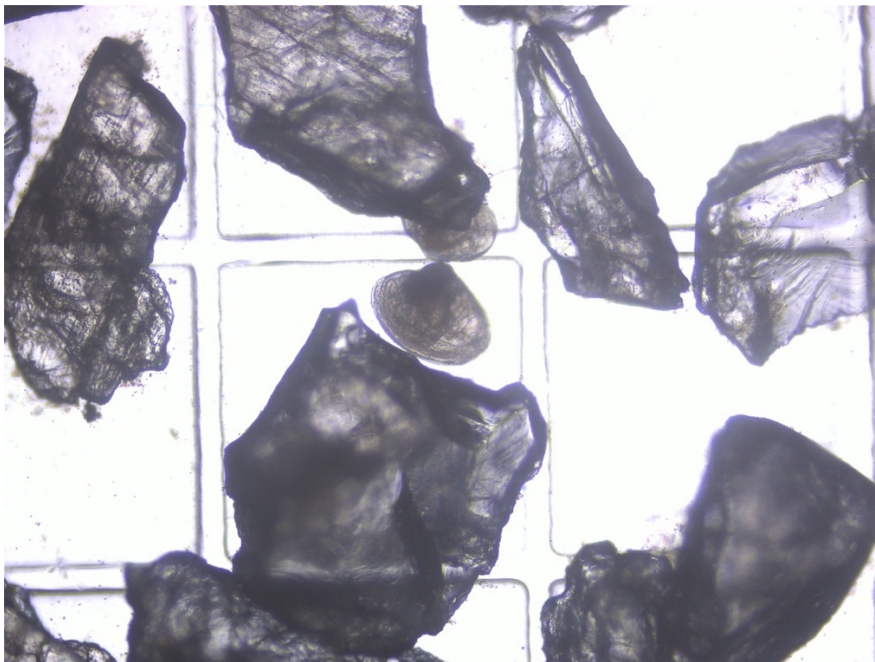
A second larval tank was set on the weekend of July 18-19th due to a high rate of spawning. This second tank had a high larval count of approximately 4 million larvae after one week in pelagic culture. Similarly to the first cohort, this second larval tank was fed 25k t-iso algal culture and were monitored through the pelagic growth stage. By day 17 upon settling the number of larvae had decreased to approximately 1,900,000 individuals.

A third spawn occurred on 7/26/2026. This event was initiated by stress-spawning the remaining razor clams in a bucket at ambient temperature. This event resulted in approximately 5 million larvae after one week in pelagic culture. By the time of settlement on day 17, 3,500,000 larvae remained. On 7/26/2026, only 8 razor clams of the 115 collected remained alive. These were dispatched and dissected to determine viability post-spawning. Five of the remaining clams had no gametes detected, one had eggs, one had immobile sperm, one had motile sperm. We concluded from this analysis that the three intensive spawning events had spent the gonads of the surviving razor clams.



D-hinge clam larvae

As of the end of August 2026, average sizes for all three sets of razor clams juveniles had reached 1 millimeter in diameter indicating a healthy rate of growth. By September 30th, 2026 average size for juveniles from Set 1 was 2.27 mm in diameter. The average size for juveniles from set 2 was 1.52 mm in diameter. The average size for juveniles in set 3 was 1.51 mm in diameter.



Juvenile clams upon settling. Note sediment present with settled clams

As of September 30th, 2026, a count of juvenile razor clams from all three sets revealed 260,000 growing in the hatchery. This number is well above the 20,000 juveniles approved for outplanting in April of 2027 under research permit P-26-029. Upon consultation and approval from our ADFG partners, we have applied to amend permit P-26-029 to allow for the release of 200,000 juvenile razor clams on Ninilchik beach in 2027. We anticipate a high rate of survival for this year's stock of juvenile razor clams as they are being held in a sandy substrate similar to their wild habitat and which we have observed to be important to juvenile survival. This higher number of 200,000 clams will be a sufficient number for us to study their survival after outplanting.

Strip Spawning

Due to relatively poor success and retention of razor clams in the first season of this project, we attempted to strip spawn the razor clams after the first spawning event. The protocol for strip spawning was written by Dr. Marina Alcantar and is provided below:

“To produce a cohort, gametes were obtained via strip-spawning (Landau, 2014), where small incision was made on the gonadal tissue located at the distal end of the bivalve foot. Gametes were observed under a light microscope to determine sex of the brood-stock individual and the relative gonadal development stage. Eggs were collected from three females and added to 1-um filtered seawater then gently rinsed through a 153 um mesh, a 63 um mesh, and a 20-um mesh consecutively to remove tissue and mucus from the eggs. The cleansed eggs were then removed from the mesh using a clean plastic transfer pipette and suspended into 1 um filtered seawater. The eggs were kept on ice for approximately 30 minutes during which time sperm was excised from one male. While sperm counts were not conducted, sperm cells were assessed for viability, and fertilization was monitored to ensure there was no evidence of polyspermy. The isolated sperm was diluted into 1 um-filtered seawater following excision. To initiate fertilization, 1 ml of sperm were then added to 400 ml of eggs at a concentration of 6,180 eggs/ml and gently mixed.”

Our first attempt at strip spawning occurred on 7/23/2026. Seven dead razor clams were dissected and had their gonads removed. Both eggs and sperm were detected via microscope analysis; however sperm was immobile and eggs appeared to be in poor condition. The first fertilization attempt from strip spawning was deemed unsuccessful.

A second attempt at strip spawning was also attempted on 7/23/2026. Five live razor clams were dissected and had their gonads removed. Microscopy of gametes revealed four male and one female razor clams amongst this group. These gametes were combined into a fertilization beaker and left to incubate for one hour. Microscope analysis detected some fertilization, and the gametes were added to a 190 L tank. On 7/24/2026, no larvae were detected in the 190 L tank.

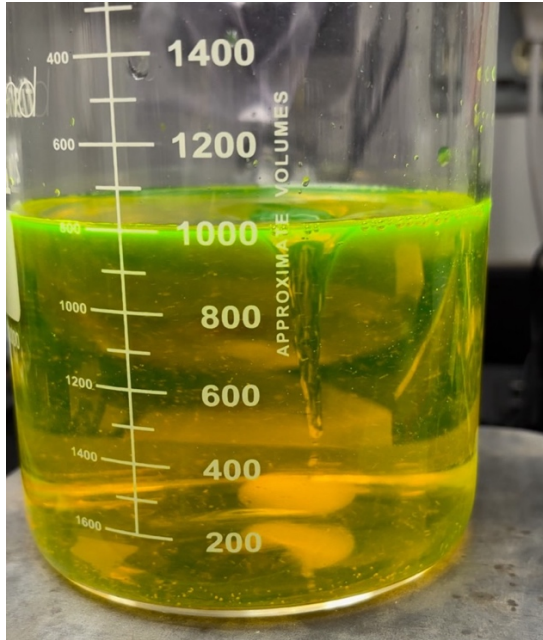
A third strip-spawning event was initiated on 7/24/2026. Two live and two dead razor clams were dissected and had their gonads removed. Analysis of gametes revealed three male and one female razor clams. Fertilization was easily initiated on a microscope slide and heavy rates of fertilization were noticed in the fertilization beaker. The gametes were added to a 190 L tank in case of fertilization. However, as of 7/27/2026 no gametes or larvae were found in the 190 L tank and the tank was drained.

As stated above, the dissection of the remaining eight razor clams revealed few viable gametes remaining. It is likely that the clams had depleted their gonads by this point. Gonadal depletion may have occurred during the heavy spawning occurring upon the arrival of the clams at APMI. It is also possible that the clams had spawned in the wild before arriving at the hatchery. The efficacy of strip spawning razor clams, as well as the ideal collection time for adult broodstock, will remain an area of research at APMI in the future.

Calcein Marking Protocol

Calcein marking is an effective method at identifying hatchery-grown shellfish upon outplanting. Typically, calcein dissolved in water is introduced to juvenile shellfish and incorporated into their shells. Juvenile razor clams from set 2 were measured on 8/25/2026. On this date, clams from set 2 averaged over 1mm in length. We decided to calcein mark after this date to test the efficacy of marking at a small size. We prepared a calcein solution mixed to a volume of .25 grams/L.

Calcein temperature at time of addition to juvenile clams was 12.5 degrees C. The juvenile razor clams were exposed to Calcein for 24 hours at 10 degrees C and placed in a separate tank from unmarked clams. As of September 30th, 2026, the calcein marked clams have survived the procedure. We will continue marking clams at different size classes to determine appropriate the most effective life stage at which to do so. Before outplanting in 2027, all juvenile razor clams will be marked with calcein as per our discussions with ADFG partners. We will work with ADFG to outplant these calcein-marked clams and use them to evaluate the success of outplanting hatchery-raised clams.



Calcein in solution used to mark juvenile clams

Lessons Learned and Challenges

We faced several challenges in the hatchery rearing of razor clams; however, we became more successful at raising the species due to our trials in this project. In both broodstock years, the adult razor clams only survived for several weeks in a hatchery environment. Unlike hardshell clams, razor clams have a weak abductor muscle and rely upon speed and quick burial to evade predation. This weak abductor muscle and sensitivity to environmental conditions causes a high rate of mortality of adult clams once removed from a wild environment.

The first year of broodstock was collected in late June of 2025; ADFG surveys indicate that gonadal maturity does not peak until later in the summer. Thus, spawning success of this brood year was lower than it was in 2026 when individuals were collected close to wild spawning seasons and peak maturity. Indeed, the mature individuals collected in 2026 spawned readily upon arrival in the hatchery. This immediate spawning initiation was likely a result of both gonadal maturity and the triggering of hatchery conditions. A stronger spawning in the hatchery – indeed, we had three successful spawning events – led to a larger cohort of juvenile razor clams that will result in a high number available for outplanting in spring of 2027.

As discussed above, we had difficulty with strip spawning the razor clams of brood year 2026. This was likely to the success of natural spawning which resulted in spent gonads before we could attempt strip spawning. Future attempts at this artificial spawning methods should occur with late season broodstock strip spawned within a day of arrival at the hatchery.

At the onset of this project, we hoped to gain expertise at calcein marking and outplanting razor clams. Unfortunately, we had a low number of juveniles in 2025 and were unable to calcein mark a significant number of animals to prove the efficacy of this monitoring technique. As only 39 clams survived to be outplanted, we were unable to reliably monitor their survival or

determine the best locations or methods of outplanting. We hope to better refine outplanting and monitoring techniques with juvenile clams raised in 2026.

Future Work

As of September 2026, APMI has a high number of juvenile razor clams growing in in the hatchery, with final counts finding 260,000 individuals. This far exceeds the 20,000 expected and we anticipate a successful outplanting of a high number of individuals in April 2027. As of September 30th, 2026 the growth rate of 2025/6 juveniles and 2026/7 juveniles is the same, although this year has a far higher rate of survival. Between October 2026 and April of 2027, we will continue to grow these animals in the hopes of a successful outplanting in 2027. Batches of juvenile razor clams will be marked with calcein at different size intervals – 1mm average, 2 mm average, 3 mm average – and 200,000 brought to Ninilchik beach for outplanting assuming that our permit amendment is accepted. Partners at ADFG will monitor outplanted clams in 2027 to determine the final success of the project. We hope to see that hatchery-raised razor clams will help to restore this personal-use fishery. We are in conversations with ADFG partners to continue the razor clam restoration project past 2027 if successful. We also hope to expand our efforts and raise razor clams in the hatchery for outplanting by tribal and community partners in Cook Inlet, Prince William Sound, and other regions of Alaska.

Sources used in this project & report

Alcantar, M. W., Hetrick, J., Ramsay, J., & Kelley, A. L. (2023). Embryonic and early larval development of the Pacific razor clam (*Siliqua patula*). *Biological Bulletin*, 245(2), 57–67. <https://doi.org/10.1086/730784>

- Alcantar, M. W., Hetrick, J., Ramsay, J., & Kelley, A. L. (2024). Examining the impacts of elevated, variable pCO₂ on larval Pacific razor clams (*Siliqua patula*) in Alaska. *Frontiers in Marine Science*, 11, 1253702. <https://doi.org/10.3389/fmars.2024.1253702>

- Bishop, M. A., & Powers, S. P. (2003, March). Restoration of razor clam (*Siliqua patula*) populations in southeastern Prince William Sound, Alaska: Integrating science, management & traditional knowledge in the development of a restoration strategy (Final report to Partners for Fish & Wildlife Coastal Program, Alaska Regional Office, U.S. Fish and Wildlife Service). Prince William Sound Science Center; Institute of Marine Sciences, University of North Carolina–Chapel Hill.

https://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/razor_clam_pws.pdf

- Booz, Michael D., et al. Sport and Personal Use Shellfish Fisheries in the Lower Cook Inlet and North Gulf Coast Management Area, 2022-2023. Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services, 2025.

- Breese, W. P., & Robinson, A. (1981). Razor clams, *Siliqua patula* (Dixon): Gonadal development, induced spawning and larval rearing. *Aquaculture*, 22, 27–33. [https://doi.org/10.1016/0044-8486\(81\)90130-7](https://doi.org/10.1016/0044-8486(81)90130-7)

- Brooks, K. M., Agosti, J., Hetrick, J., & Daisy, D. (1999). Clam restoration project (Restoration Project 99131: Final report). Exxon Valdez Oil Spill Trustee Council. <https://evostc.state.ak.us/media/2257/1999-99131-final.pdf>

- Brooks, K. M. (2004, October 15). Suitability of two sand bars near the Native Village of Eyak for the enhancement of razor clams (*Siliqua patula*) (Report prepared for the Native Village of Eyak). Aquatic Environmental Sciences.

https://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/eyak_razorclam_report.pdf

- Bourne, N. (1979). Razor clam, *Siliqua patula* Dixon, breeding and recruitment at Masset, British Columbia. *Proceedings of the National Shellfisheries Association*, 69, 21–29. https://ia601300.us.archive.org/6/items/proceedingsofnat69nati/proceedingsofnat69nati_bw.pdf

- Bourne, N., & Quayle, D. B. (1970). Breeding and growth of razor clams in British Columbia (Fisheries Research Board of Canada Technical Report No. 232). [No free public PDF located; cited in a public management-plan source:] <https://waves-vagues.dfompo.gc.ca/library-bibliotheque/41061329.pdf>

- Costa, F. D., Martínez-Patiño, D., Ojea, J., & Nóvoa, S. (2010). Larval rearing and spat production of the razor clam *Ensis siliqua* (Bivalvia: Pharidae). *Journal of Shellfish Research*, 29(2), 347–351. <https://doi.org/10.2983/035.029.0209>

- Flanagan, M. P. (2013). Investigation of early development and importance of sediment choice in the hatchery production of razor clams, *Ensis directus* (Honors thesis, University of Maine). <https://files01.core.ac.uk/download/pdf/217051473.pdf>

- Freudendahl, A. S. L., & Nielsen, M. M. (2005, October). Cultivation of American razor clam: Screening of potential for commercial cultivation. Danish Seafood Center; Aarhus University. <https://docslib.org/doc/7722663/cultivation-of-american-razor-clamscreening-of-potential-for-commercial-cultivation>

- Gribben, P. E. (2005). Gametogenic development and spawning of the razor clam, *Zenatia acinaces* in northeastern New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 39(6), 1287–1296. <https://doi.org/10.1080/00288330.2005.9517393>
- Nickerson, R. B. (1975). A critical analysis of some razor clam (*Siliqua patula*, Dixon) populations in Alaska (294 pp.). Alaska Department of Fish and Game. <https://www.arlis.org/docs/vol1/I/3073111.pdf>
- Phibbs, F. D. (1968). Laboratory hatching and rearing of Pacific Coast clams and oysters: Annual report (July 1, 1967–June 30, 1968). Oregon Fish Commission; U.S. Bureau of Commercial Fisheries. <https://digitalcollections.library.oregon.gov/nodes/view/301661>
- Rawson, P., Leavitt, D., Morse, D., & Murphy, D. (2015). Optimization of hatchery and culture technology for razor clams (Final technical report; Subaward No. Z540402; Grant No. 2010-38500-21074). University of Maine. https://seagrant.whoi.edu/wpcontent/uploads/2015/01/Razor-Clam-Final-Technical-Report-NRAC_Z540402.pdf
- Rickard, N. A., & Newman, R. A. (1986). Development of technology for harvesting and transplanting subtidal juvenile Pacific razor clams, *Siliqua patula* Dixon, along the coast of Washington State. *National Shellfisheries Association Quarterly Newsletter* (Spring). https://shellfish.memberclicks.net/assets/docs/Archived_Newsletters/1986%20spring%20may.pdf
- Hetrick, J. (2009). Alutiiq Pride Shellfish Hatchery basic management plan (2009–2013) [Unpublished internal document].
- Hetrick, J. (2025). Hatchery protocols for razor clam (Draft). Alutiiq Pride Marine Institute hatchery manual [Unpublished internal document]