UNITED STATES DEPARTMENT OF AGRICULTURECOOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

PROPOSAL COVER PAGE

1. LEGAL NAME OF ORGANIATION TO WHICH AWARD SHOULD BE MADE
The Research Foundation of State University of New York

3. NAME AND TITLE OF AUTHORIZED ORGANIZATIONAL REPRESENTATIVE (AOR)
Sabrina Cerezo, Assistant Director for Grants

2. ADDRESS
Office of Sponsored Programs
Melville Library Suite W5501
Stony Brook University
Stony Brook, NY 11794-3362

4. a. Telephone No.: (631) 632-9840

b. Fax Number: (631) 632-6963

c. E-mail Address: sabrina.cerezo@stonybrook.edu

5. ADDRESS OF AOR (If different from Item 2.)

6a. TYPE OF PERFORMING ORGANIZATION (Choose 1 only)

01 ☐ USDA Agency
02 ☐ Other Federal Agency/Department
03 ☐ 1862 Land-Grant University
04 ☐ 1890 Land-Grant University (including Tuskegee Univ.)
05 ☐ 1994 Land-Grant University
06 ☐ Private University of College
07 ☐ Non-Land-Grant Public University or College
04 ☐ 1890 Land-Grant University
08 ☐ Private For-Profit
09 ☐ Private Non-Profit
10 ☐ Public Secondary School
11 ☐ State, Local or Tribal Government
12 ☐ Individual
13 ☒ Other

6b. In addition, PLEASE CHECK ANY OF THE FOLLOWING THAT APPLY:

☐ Alaska Native-Serving Institution
☐ Cooperative Extension Service
☐ Native Hawaiian-Serving Institution
☐ Hispanic-Serving Institution
☐ Historically Black College or University (other than 1890)
☐ School of Forestry
☐ State Agricultural Experiment Station
☐ Tribal College (other than 1994)
☐ Veterinary School or College

7. TITLE OF PROPOSED PROJECT: Development of resistant bay scallop strains for aquaculture in the Northeast

8. PROGRAM TO WHICH YOU ARE APPLYING (Include Program Area and Number: Refer to Federal Register announcement or program solicitation where applicable)
NRAC/ TRA-21-2

9. TAX IDENTIFICATION NO. (TIN) 14-1368361

10. CONGRESSIONAL DISTRICT NO. NY-01

11. DUNS NO. (Data Universal Numbering System) 804878247

12. PROPOSED START DATE
03/01/2021

13. DURATION REQUESTED (No. of months): 24 months

14. TYPE OF REQUEST (Check only one)

☒ New ☐ Renewal ☐ Supplement ☐ Resubmission ☐ Resubmitted Renewal

☐ Continuing Increment ☐ PD Transfer [PRIOR USDA Award No. _____]

15. FEDERAL FUNDS REQUESTED (From Form CSREES-2004)
$69,965

16. PROJECT DIRECTOR (PD)
Emmanuelle Pales Espinosa

18. a. PD Phone No.: (631) 632-8694

b. PD Fax No.: (631) 632-8915

c. PD E-mail Address: emmanuelle.palesespinosa@stonybrook.edu

17. PD BUSINESS ADDRESS (INCLUDE DEPARTMENT/ZIP CODE)
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000

19. CO-PD(s) NAME	TELEPHONE NUMBER	E-MAIL ADDRESS
Bassem Allam	631) 632-8745	bassem.allam@stonybrook.edu
Stephen Tettelbach	(631) 862-8660	stt47@cornell.edu
Karen Rivara	(631) 765-1808	Keeno1959@gmail.com
Emma Green-Beach	(508) 542-1339	emma.greenbeach@mvshellfishgroup.org

20. IF THIS IS A RESEARCH PROJECT, WILL IT INVOLVE RECOMBINANT DNA, HUMAN SUBJECTS, OR LIVING VERTEBRATE ANIMALS?

☒ No ☐ Yes (If yes, complete Form CSREES-2008)

21. WILL THIS PROJECT BE SENT OR HAS IT BEEN SENT TO OTHER FUNDING AGENCIES, INCLUDING OTHER USDA AGENCIES?

☒ No ☐ Yes (If yes, list Agency acronym(s) & program(s))

By signing and submitting this proposal, the applicant is providing the required certifications set forth in 7 CFR Part 3017, as amended, regarding Debarment and Suspension and Drug-Free Workplace; and 7 CFR Part 3018 regarding Lobbying. Submission of the individual forms is not required. (Please read the Certifications included in this booklet before signing this form.) In addition, the applicant certifies that the information contained herein is true and complete to the best of its knowledge and accepts as to any award the obligation to comply with the terms and conditions of the Cooperative State Research, Education and Extension Service in effect at the time of the award.

SIGNATURE OF PROJECT DIRECTOR(S) (All PDs listed in blocks 16 or 19 must sign if they are to be included in award documents.)

DATE
10/12/2020

SIGNATURE OF AUTHORIZED ORGANIZATIONAL REPRESENTATIVE (Same as Item 3)

DATE
10/15/20

NRAC Project Summary
(2020 Solicitation for 2021 Funds)

Project Title: **Development of resistant bay scallop strains for aquaculture in the Northeast**

Project Status/Duration:	New **X**	Con't._ _ _ _ _	Project Period: **24 months**

Name, Address, and Telephone Number of Project Coordinator:

Emmanuelle Pales Espinosa / Research Associate Professor / School of Marine and Atmospheric Sciences / Stony Brook University / Stony Brook, NY 11794-5000 / Phone: 1 631 632 8694 / Fax: 1 631 632 8915 / E-mail: emmanuelle.palesespinosa@stonybrook.edu

Principal Investigators and Brief Statement of Qualifications:

Emmanuelle Pales Espinosa (Research Associate Professor, Shellfish Ecological Physiology and Pathology), **Bassem Allam** (Professor, Shellfish Pathology, Physiology and Genomics), **Stephen Tettelbach** (Senior Educator, Shellfish Ecology with a specialization in scallop ecology), **Karen Rivara** (President of Aeros Oyster Co., Shellfish Breeding), **Emma Green-Beach** (Executive Director, Martha's Vineyard Shellfish Group, Inc., Shellfish Breeding)

Project Objectives:

(O1) Evaluate if the large-scale scallop mortality events have resulted in the survivorship of resistant individuals
(O2) Assess if resistance to bay scallop coccidia and temperature stress is a heritable trait
(O3) Maintain the best performing scallops for the development of resistant lines as part of future aquaculture programs

Specific Priority in Solicitation to which Project Responds:
TRA-21-2 - Goal: Research and demonstrate opportunities for increased profitability

Keywords: Bay Scallop, *Argopecten irradians*, Disease, Temperature stress, Resistance, Northeast

Summary of Work:
Adult bay scallop (*Argopecten irradians* subpsp. *irradians*) populations in the Peconic estuary (east end of Long Island, NY) have suffered severe mortality events in summers 2019 and 2020. Evidence suggests that the cause of the mortalities is a combination of temperature stress and infection by an Apicomplexan parasite dubbed bay scallop coccidia (BSC). This **proof of concept (seed grant) application** is designed to test the hypothesis that the extensive selection pressure exerted by these large-scale mortality events resulted in the selection of resistant scallops. We propose to use traditional approaches of selective breeding to determine if signatures of selection can be detected, therefore allowing the identification of superior strains of bay scallops that are more resistant to biological and environmental stressors impacting growth and survival. The overarching objective of the work is to identify scallops that better resist BSC and temperature stress. To do so, we will contrast the performance of offspring derived from adult scallops that were exposed, or not, to the selective mortality events. The work will serve as a pre-requirement for the future development of selective breeding programs for the bay scallop, in support of the sustainability and growth of the aquaculture industry. Given the high farm-gate value of this crop and dwindling wild capture, the potential for aquaculture growth of the industry is extremely important. In this framework, identification of bay scallop stocks that better resist BSC and stressful temperature is a major priority for a broad range of stakeholders. Our expected results will optimize aquaculture efforts in the Northeast and facilitate the recovery of bay scallops in NY waters and will serve as a reference for establishing selective breeding programs across the region.

Project Funding:

	Year 1	%		Year 2	%		Total	%
NRAC	$29,948	100 %	NRAC	$40,017	100 %	NRAC	$69,965	100 %
Match	$	%	Match	$	%	Match	$	%
Total	$29,948	100 %	Total	$40,017	100 %	Total	$69,965	100 %

2021 Proposal to the Northeastern Regional Aquaculture Center (NRAC) for USDA National Institute of Food and Agriculture (NIFA) Funding

Section 1.1

Proposal Code (See cover letter)**:** **TRA-21-2**

Project Title: Development of resistant bay scallop strains for aquaculture in the Northeast

[Yes] the title is the same as the Pre-proposal

Total Funding Requested from NRAC: $69,965 **Total Match:** $0 (not allowed by SBU unless required by the agency)

Project Duration (total): **24 Months**

Resubmission Information: Not applicable

Preferred Start Date (circle/list): March 1, 2021

States with Participants in Project (circle/list):

MA CT NY

Project Coordinator (Lead Principal Investigator) (one name only)

Emmanuelle Pales Espinosa, Research Associate Professor
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000
Phone: 1 631 632 8694
Fax: 1 631 632 8915
E-mail: emmanuelle.palesespinosa@stonybrook.edu

Does this Project Request rental for space or use fees: No

If yes the institutions authorized signature on this proposal attests that this space rental or these fees are not included in the institution's normal overhead calculations.

Project Coordinator's Signature: **Date: 10/12/2020**

University Approving Official: _____ **Date:** 10/15/20

Section 1.2

Principal Investigators:

Dr. Emmanuelle Pales Espinosa / Research Associate Professor / School of Marine and Atmospheric Sciences / Stony Brook University / Stony Brook, NY 11794-5000 / Phone: 1 631 632 8694 / Fax: 1 631 632 8915 / E-mail: Emmanuelle.Palesespinosa@stonybrook.edu

Dr. Bassem Allam / Professor / School of Marine and Atmospheric Sciences / Stony Brook University / Stony Brook, NY 11794-5000 / Phone: (631) 632-8745 / Fax: (631) 632-8915 / E-mail: bassem.allam@stonybrook.edu

Dr. Stephen Tettelbach / Shellfish Ecologist / Cornell Cooperative Extension of Suffolk County / Cornell University / Southold, NY 11971 / Phone: (631) 862-8660 / Email: stt47@cornell.edu

Mrs. Karen Rivara / President / Aeros Cultured Oyster Company / 10273 N Bayview Rd / Southold, NY 11971 / Phone (631) 765-1808 / Email: keeno1959@gmail.com

Mrs. Emma Green-Beach / Director / Martha's Vineyard Shellfish Group, Inc. / P. O. Box 1552 / Oak Bluffs, MA 02557 / Phone (508) 542-1339 / Email: emma.greenbeach@mvshellfishgroup.org

Tettelbach also serves as extension coordinator through Cornell Cooperative Extension of Suffolk County

Industry partners:

Rick Karney / Director Emeritus / Martha's Vineyard Shellfish Group, Inc. / P. O. Box 1552 / Oak Bluffs, MA 02557 / Phone (508) 693-0391 / Email: mvsg@comcast.net

Donald J. King / Montowese Bay Scallops / 275 Linden Avenue / Branford, CT 08405 / Phone (203) 488-6926 / Email: dking13@snet.net

* Karen Rivara / President / Aeros Cultured Oyster Company / 10273 N Bayview Rd / Southold, NY 11971 / Phone (631) 765-1808 / Email: keeno1959@gmail.com

* Emma Green-Beach / Director / Martha's Vineyard Shellfish Group, Inc. / P. O. Box 1552 / Oak Bluffs, MA 02557 / Phone (508) 542-1339 / Email: emma.greenbeach@mvshellfishgroup.org

**: Rivara and Green-Beach are also co-PIs*

Section 1.3

Emmanuelle Pales Espinosa, Research Associate Professor

1. **Please list the titles, co-P.I.s and years funded of any previous NRAC competitive grant(s) in the last five years.**

Genetic marker-assisted selection of Northeastern hard clams for QPX resistance. Bassem Allam, Ximing Guo, Roxanna Smolowitz, Emmanuelle Pales Espinosa, Gregg Rivara. February 1, 2013 through January 31, 2016.

2. **If any previously funded grants led to successful awards of larger grants from other agencies by you or your co-P.I.s please list them below by linking which NRAC grant led to a new larger grant, what agency funded it, and at what level.**

Resistant clams and genetic markers identified in the above project were used as background to support the development of a new research project funded by the USDA/NIFA: Validation of markers and marker-assisted selection of hard clams for QPX resistance. Bassem Allam, Ximing Guo, Roxanna Smolowitz, Emmanuelle Pales Espinosa, Gregg Rivara, Diane Murphy ($326,998), 9/15/16-9/14/19.

3. **If any industry/stakeholder have adopted and put into practice the results from previous NRAC funding please list the name of the company/agency/stakeholder that has adopted the practice and estimate the value-added result of adoption.**

Information on the best performing clam strain identified in the study has been diffused through general and targeted outreach initiatives that are being pursued under the ongoing NIFA project. The largest shellfish hatchery in New York State (Frank M. Flowers and Sons, Oyster Bay, NY) has been successfully using that strain in their breeding program and no QPX disease outbreak has been recorded in their extensive clam cultures in recent years.

Section 1.3

Bassem Allam, Professor

4. **Please list the titles, co-P.I.s and years funded of any previous NRAC competitive grant(s) in the last five years.**

Genetic marker-assisted selection of Northeastern hard clams for QPX resistance. Bassem Allam, Ximing Guo, Roxanna Smolowitz, Emmanuelle Pales Espinosa, Gregg Rivara. February 1, 2013 through January 31, 2016.

5. **If any previously funded grants led to successful awards of larger grants from other agencies by you or your co-P.I.s please list them below by linking which NRAC grant led to a new larger grant, what agency funded it, and at what level.**

Resistant clams and genetic markers identified in the above project were used as background to support the development of a new research project funded by the USDA/NIFA: Validation of markers and marker-assisted selection of hard clams for QPX resistance. Bassem Allam, Ximing Guo, Roxanna Smolowitz, Emmanuelle Pales Espinosa, Gregg Rivara, Diane Murphy ($326,998), 9/15/16-9/14/19.

6. **If any industry/stakeholder have adopted and put into practice the results from previous NRAC funding please list the name of the company/agency/stakeholder that has adopted the practice and estimate the value-added result of adoption.**

Information on the best performing clam strain identified in the study has been diffused through general and targeted outreach initiatives that are being pursued under the ongoing NIFA project. The largest shellfish hatchery in New York State (Frank M. Flowers and Sons, Oyster Bay, NY) has been successfully using that strain in their breeding program and no QPX disease outbreak has been recorded in their extensive clam cultures in recent years.

Section 1.3

Stephen Tettelbach, Shellfish Ecologist: No prior NRAC funding

Karen Rivara, President of Aeros Oyster Co. (Shellfish farmer): No prior NRAC funding

Emma Green-Beach, Director of the Martha's Vineyard Shellfish Group, Inc: No prior NRAC funding

2.1. Objectives

Adult bay scallop (*Argopecten irradians* subpsp. *irradians*) populations in the Peconic estuary (east end of Long Island, NY) have suffered severe mortality events in summers 2019 and 2020. Evidence suggests that the cause of the mortalities is a combination of temperature stress and infection by an Apicomplexan parasite dubbed bay scallop coccidia (BSC). This **proof of concept (seed grant) application** is designed to test the hypothesis that the extensive selection pressure exerted by these large-scale mortality events resulted in the selection of resistant scallops. We propose to use traditional approaches of selective breeding to determine if signatures of selection can be detected, therefore allowing the identification of superior strains of bay scallops that are more resistant to biological and environmental stressors impacting growth and survival. The overarching objective of the work is to identify scallops that better resist BSC and temperature stress. To do so, we will contrast the performance of offspring derived from adult scallops that were exposed, or not, to the selective mortality events. The specific objectives of the proposal are to:

(O1) Evaluate if the large-scale mortality events have resulted in the survivorship of resistant scallops,

(O2) Assess if resistance to BSC and temperature stress is a heritable trait, and

(O3) Maintain the best performing scallops for the development of resistant lines as part of future aquaculture programs

The work will serve as a pre-requirement for the future development of selective breeding programs for the bay scallop, in support of the sustainability and growth of the aquaculture industry.

2.2. Justification and Related work

The bay scallop, *Argopecten irradians*, is a commercially, culturally and ecologically important species found along the US Atlantic and Gulf coasts. The northern subspecies, *A. i. irradians*, which occurs naturally from Massachusetts to New Jersey (Clarke 1965), typically commences broadcast spawning in summer and, following fertilization, developing larvae remain in the plankton for 1-2 weeks (Belding 1910). Settling larvae then attach to eelgrass, *Zostera marina* (their preferred habitat) or macroalgae – which provide above-bottom spatial refuges from some of their predators (Belding 1910; Tettelbach 1986, 1991; Garcia-Esquivel & Bricelj 1993). Northern bay scallops exhibit very rapid shell growth in their first year (10-12 mm/month: Bricelj *et al.* 1987; Tettelbach 1991; Carroll *et al.* 2012), typically reaching shell heights of 40 to >50 mm by their first winter (Tettelbach 1991, Tettelbach *et al.* 2015). These scallops will themselves spawn in the following summer at an age of ~1 year and recruit to the fishery in the fall. However, most of the bay scallop population will die naturally at an age of 18-22 months; thus spawning effectively occurs in just one year (Belding 1910). For this reason, bay scallops are particularly susceptible to dramatic population fluctuations – as evidenced in commercial fishery landings throughout their range (Belding 1910; MacKenzie 2008).

Bay scallop populations and landings have exhibited overall declines over almost all of their natural range in the 20th and 21st centuries - due to harmful algal blooms (Cosper *et al.* 1987;

Summerson & Peterson 1990; Tettelbach & Wenczel 1993), habitat alteration and, in some areas, overfishing (Arnold et al 1998; Marelli *et al.* 1999, Carroll *et al.* 2012). Historically, bay scallops supported a significant fishery on Long Island, New York prior to the mid-1980's; this was valued at ~$2 million and employed 400-600 full-time baymen (Rose 1987; Kahn & Rockel 1988). In many ways the bay scallop was symbolic of life on the East End as the bulk of the landings came from the Peconic Bays. In 1985, however, the first recorded brown tide (*Aureococcus anophagefferens*) algal bloom directly caused up to 95% mortality of adult bay scallops (Cosper *et al.* 1987; Bricelj *et al.* 1987; Tettelbach & Wenczel, 1993). After further brown tide blooms in 1986 and 1987, Peconic bay scallop populations were nearly extirpated (Tettelbach & Wenczel, 1993) and commercial landings declined to 1% of historical, pre-brown tide levels (NYSDEC 2020).

Bay scallop restoration in the Peconic Bays, using hatchery-reared scallops, was initiated soon after the first brown tide with the goal of planting juveniles (0+ yr) that would spawn at maturity (~1 yr) and help repopulate the bays (Tettelbach & Wenczel 1993). Plantings in the mid 1980's to early 1990's contributed to an increase in Peconic scallop populations (Krause 1992), but recurring brown tides wiped out these gains. Despite the absence of brown tide blooms since 1995, however, scallop populations remained at very low levels over the next 12 years. Our group hypothesized that low scallop density/abundance resulted in impaired fertilization success and recruitment limitation (Summerson & Peterson 1990; Levitan and Petersen 1995; Peterson & Summerson 1992; Marelli *et al.* 1999; Liermann and Hilborn 2001), and we attempted to jump-start the rebuilding of natural bay scallop populations by increasing larval supply via high-density plantings of several million hatchery-reared animals deployed in spawner sanctuaries (Tettelbach & Smith 2009, Tettelbach *et al.* 2011, 2013, 2015). Following commencement of these intensive restoration efforts, we documented dramatic increases in bay scallop larval settlement, population densities and fishery landings – the latter up to 32× higher than pre-restoration baseline levels (Tettelbach *et al.* 2013, 2015) (Figure 1). Over the period from the initiation of our restoration efforts (2006) to 2019, cumulative dockside revenues to baymen increased by over $7.5 million, compared to the 12 prior years; with economic multipliers, the benefit to local fish markets, restaurants and other related businesses exceeded $75 million (Tettelbach *et al.* 2015; Tettelbach unpub data). Our analyses revealed that these scallop population increases were not correlated to coincidental changes in adult scallop fecundity or environmental factors, but rather were driven by our restoration efforts (Tettelbach *et al.* 2013).

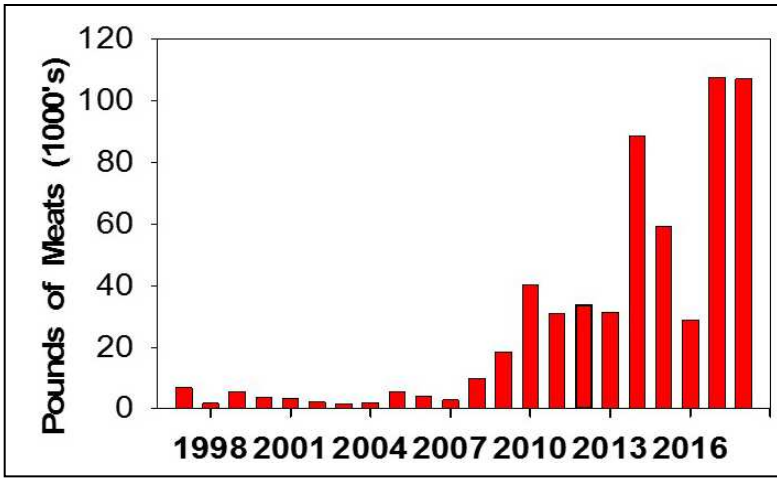

Figure 1. Annual commercial bay scallop landings for the Peconic Bays, Long Island, NY.

While scallop aquaculture in the United States has never approached the commercial success attained in China with *Argopecten irradians* (Guo and Luo 2006) or in other countries with other pectinid species (e.g. Japan: Kosaka and Ito 2006), hatchery production has formed the basis for numerous US efforts to restore bay scallops to areas where they were formerly abundant (MacKenzie 2008). Besides the unparalleled success (in the US) of our bay scallop restoration efforts, other documented increases in local populations and/or fisheries have resulted from plantings in Massachusetts (Turner 1995; R. Karney, pers comm), North Carolina (Peterson *et al.* 1996) and Florida (Arnold *et al.* 2005). Aquaculture-based bay scallop restoration efforts benefit from the very rapid growth and high reproductive potential of the species (Belding 1910) and the ease with which selective breeding can be conducted. Currently, there are a total of 10 hatcheries that produce bay scallop in the Northeast including 7 private and 3 public hatcheries, which indicate that there is interest in the cultivation of that species (https://ecsga.org/wp-content/uploads/2020/06/2020HatcheryNurseryDirectory.pdf).

In the last two years, 2019 and 2020, catastrophic mortality of adult bay scallops occurred throughout the Peconic Bays of Long Island, New York; these die-offs have severely impacted baymen and the local economy. In 2019, adult populations declined by ~95% (Tettelbach, unpub data) and, similarly, commercial landings for the harvest season of November 2019 - March 2020 were 95% lower than those in the prior two scallop seasons (NYSDEC 2020). Our 2020 Peconic population dive surveys have shown similar levels of mortality, and fishery landings for the upcoming season are projected to be grim (Tettelbach, unpub data). In our summer 2020 surveys, conducted at sites with the highest scallop densities recorded in June 2020, we observed 52-56% mortality in the ensuing 1.5 - 2 months (Tettelbach unpub data). The high mortality levels in 2019 and 2020 were associated with the emergence of an undescribed parasite that disrupts the tissues of infected animals (Figure 2). Genetic analysis showed that the parasite belongs to the *Coccidia* (hereby designated Bay Scallop Coccidia or **BSC**). Coccidians belong to the *Apicomplexa*, and all members of the phylum are parasitic (Morrison 2009; Levine 2018). Given their medical and veterinary importance, coccidian parasites of higher vertebrates (e.g. *Plasmodium* sp., *Toxoplasma* sp., *Cryptosporidium* sp.) are often well-studied and genetically characterized (e.g. life cycle, sequence information, host-pathogen interactions). In contrast, very little information is available for *Coccidia* that infect invertebrates. Nevertheless, our observations showed that BSC have a tropism for kidney tissues, but is also capable of colonizing and disrupting a broad range of scallop tissues including the adductor muscle, gonad and gills (Figure 2). Furthermore, disease intensity and mortality were strikingly higher in adult

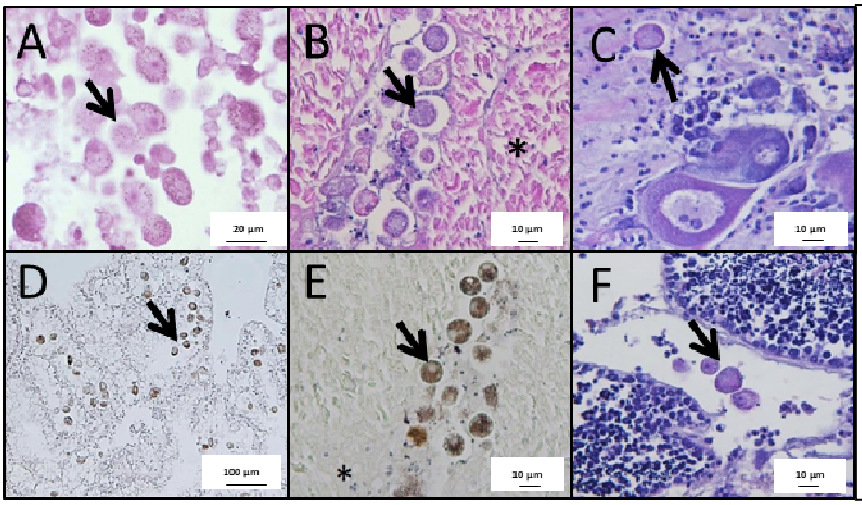

Figure 2. BSC infections (arrows point to parasite cells) in kidney (A and D), adductor muscle (B and E), and female (C) and male (F) gonads. D and E are in situ hybridization preparations using DNA probes specific to BSC. Note the atrophy of muscle fibers (*).

(market-size) animals as compared to young-of-the-year juveniles, suggesting disease pressure intensifies with scallop age. It should be noted that the mortality events in 2019 and 2020 happened during unusually warm summers characterized by temperatures in excess of 28°C for extended periods. Our experimental work further highlights the importance of temperature and showed that temperature stress exacerbates the infection leading to significantly higher mortality of infected scallops (Figure 3). Interestingly, significant differences in resistance were demonstrated between different scallop stocks, with mortality levels significantly lower in wild scallops as compared to aquacultured stocks (Figure 3), even though our results do not currently allow us to determine whether wild stocks are more resistant to BSC, to temperature stress, or to a combination of both stressors. Finally, it is noteworthy that previous work reported similarly-looking parasites in bay scallops from the Northeast and speculated that disease and mortality intensify under "stressful conditions", without specifying such stressful conditions (Leibovitz *et al.* 1984).

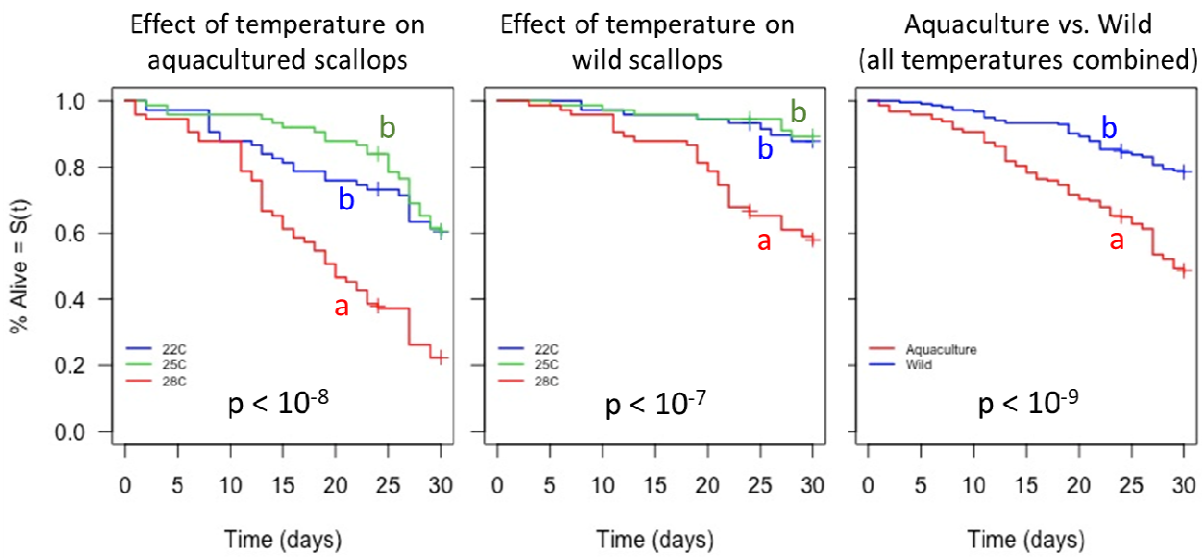

Figure 3. Effect of temperature stress on survivorship of adult scallops derived from an aquacultured line or from wild stocks. Each curve in the first two panels represents the average of 3 replicate laboratory experiments with 25 scallops each. Each curve in the last panel represents the average of a total of 225 scallops (in 9 replicates). P values are derived from Kaplan-Meier survival analyses. Different letters (a, b) within each panel indicate statistically different groups.

In this context, there is a growing body of information suggesting that bay scallop mortality in the field during summer results from a combination of environmental stressors (high water temperature) and infection by BSC. Given the ongoing and predicted increase in summer water temperatures in the Northeast as a result of climate change, similar large-scale mortality events may become more common throughout the region in the coming years. Nevertheless, our findings also highlight the importance of the genetic background of scallop stocks for resisting temperature and/or BSC stress. In this context, the strategy with the highest probability of ameliorating the outlook for bay scallop restoration and aquaculture is to employ proven aquaculture practices to selectively breed bay scallops for resistance to high water temperature and BSC so that these scallops can be used as broodstock for the growth of the industry.

Hatchery production of seed is a main component of bivalve aquaculture growth. In this context, the production of quality seed able to survive under disease and environmental stress represents a major priority for the research and aquaculture community. The finding of contrasting performance between scallop stocks (see the previous paragraph) is not surprising as host physiology (including immune defense and response to stress) is controlled by many genes, and variation at these genes leads to differences in resistance and survival. In fact, investigations in several bivalve species, including our own work (Dahl et al. 2008; Wang et al. 2016; Farhat et al. 2020), have shown a genetic basis for bivalve resistance to a broad range of biological and environmental stressors (reviewed in Tan et al 2020). This information has been used to optimize and accelerate the selection of bivalve stocks for various economically-important traits (Table 1). Given genetic variation, scallop resistance against BSC and temperature stress can be improved through selective breeding. The aim of the selective breeding is to select for individuals showing beneficial traits (faster growth, better resistance to disease or environmental stress) and use these as broodstock for the next generation. This can be done through (1) traditional "mass selection" (most simple and common process generally implemented in commercial hatcheries), (2) via a family-based selection program (allows for a better control of inbreeding), or (3) a combination of both approaches (Ward *et al.* 2005; Kube *et al.* 2011).

Table 1. A non-exhaustive representation of successful breeding effort for the production of bivalve stocks that are resistant to environmental and disease stress. Modified from Tan et al. 2020.

Stressors	**Species**	**Country**	**References**
Ocean warming	*Chlamys nobilis**	China	Zheng et al. 2012a,b ; 2015
	Crassostrea gigas	USA	Perdue et al. 1981 ; Beattie et al. 1980 ; Hershberger et al. 1984
	Mercenaria mercenaria	USA	Baker et al. 2011
	*Mizuhopecten yessoensis**	China	Wang et al. 2014
Ocean acidification	*Crassostrea gigas*	USA	de Melo et al. 2016
	Mytilus edulis	USA	Thomsen et al. 2017
	Saccostrea glomerata	Australia	Nell et al. 1996 ; Parker et al. 2015 ; Thompson et al. 2015
Summer mortality disease	*Crassostrea gigas**	France	Degremont et al. 2005, 2007, 2010, 2015a, 2015b
Juvenile oyster disease (JOD)	*Crassostrea virginica*	USA	Farley et al. 1995, 1996 ; 1997 ; Barber et al. 1998 ;
MSX disease	*Crassostrea virginica*	USA	Ford and Haskin 1979; Burreson 1991; Ragone Calvo et al. 2003; Frank-Lawale et al. 2014
Dermo disease	*Crassostrea virginica*	USA	Burreson 1991; Ragone Calvo et al. 2003; Frank-Lawale et al. 2014
QX disease	*Saccostrea glomerata*	Australia	Nell 2003 ; Nell and Perkins 2006, Dove 2013
Bonamia disease	*Ostrea edulis*	France	Naciri-Graven 1998
Winter mortality disease (*Bonamia roughleyi*)	*Saccostrea glomerata*	Australia	Dove 2013

**: scallops (C. nobilis and M. yessoensis) selective breeding for ocean warming and oyster (C. gigas) selective breeding for summer mortality also involve selection for opportunistic pathogens.*

In bivalves, traditional selective breeding has been previously used to produce crops with specific shell characteristics (Nell and Perkins 2005), growth performance (Guo 2004), disease

resistance (Calvo *et al.* 2003; Davis and Barber 1999; Ford and Haskin 1987; Ford *et al.* 1990; Guo 2009) and resistance to stressful environmental conditions (Table 1). For example, The Frank M. Flower's Oyster Company in New York has been breeding eastern oysters (*Crassostrea virginica*) targeting mainly fast growth (FMF strain) and resistance to Juvenile Oyster Disease (a bacterial infection caused by *Aliiroseovarius crassostreae;* Davis and Barber 1999). Two other strains of the same species, NEH and DBH (a.k.a. XB) have been developed by Rutgers University and have demonstrated strong resistance to the pathogen *Haplosporidium nelsoni* (a.k.a. Multi-Sphere Unknown or MSX) and moderate resistance to the alveolate parasite *Perkinsus marinus* (a.k.a. Dermo; Guo *et al.* 2003; Guo *et al.* 2008a). Similarly, several studies highlighted the heritability of bivalve resistance to stressful environmental conditions (e.g. oyster resistance to low salinity, McCarty *et al.* 2020; clam resistance to high temperature, Baker *et al.* 2011; oyster and mussel resistance to ocean acidification, Nell *et al.* 1996; Parker *et al.* 2015; Thomsen *et al.* 2017) enabling the development of selective breeding programs (Table 1). Interestingly, recent studies also showed that selection of bivalves that are resistant to infectious diseases sometimes provides an unintended benefit of resistance to stressful environmental conditions as was the case for Sydney rock oysters selected for resistance against QX disease which also showed resistance to ocean acidification (Parker *et al.* 2011; Fitzer *et al.* 2019). In scallops, previous investigations in *Chlamys nobilis* (noble scallop) and *Mizuhopecten yessoensis* (Japanese scallop) evaluated strategies to manage the "summer mortality" syndrome, which is caused by increasing water temperature during summer months. In both species, investigations demonstrated a significantly better resistance against temperature stress in selected scallop lines as compared to unselected lines, confirming that selective breeding for temperature resistance in scallop (at least in *C. nobilis* and *M. yessoensis*) is possible (Cheng *et al.* 2019; Wang *et al.* 2014; Zheng *et al.* 2012a and b; Tan *et al.* 2020). Interestingly, selection of both scallop species was successful even without a full understanding of mechanisms underlying these summer mortality events, which are thought to also involve opportunistic pathogens (Wang *et al.* 2014; Tan *et al.* 2020).

In summary, investigations in several bivalve species, including our own work (Dahl *et al.* 2008; Wang *et al.* 2016; Farhat *et al.* 2020), have shown a genetic basis for bivalve resistance to a broad range of biological and environmental stressors (e.g. disease resistance, high temperature resistance, low salinity resistance, resistance to ocean acidification). This information has been used to optimize and accelerate the selection of bivalve stocks for various economically-important traits. This **"seed" proposal** aims to identify bay scallop stocks that better resist BSC and heat stress. The bay scallop fishery in most Northeastern states greatly relies on stock enhancement activities performed by public and private hatcheries. In fact, the extent of public restoration activities places the fishery more as a ranching activity than a wild fishery. The federal fishery disaster declaration submitted by Governor Cuomo in response to the bay scallop mortality event of 2019 highlights the importance of this industry in NY State. In addition to the major importance of scallop aquaculture activities intended for stock enhancement, several commercial hatcheries produce bay scallop seed for aquaculture purposes. The bay scallop is an appreciated, high value crop that can reach market size within a single growing season (6 to 8 months) setting it aside from all aquacultured bivalve species in the Northeast. There are 10 hatcheries (7 private and 3 public) hatcheries that produce bay scallops in the Northeast and the species is already aquacultured by farmers in several states (NY, CT, MA) including by private partners on this proposal, and there is a growing interest among oyster growers for diversifying activity and farming bay scallops as demonstrated by recent state funding in MA to develop

aquaculture activity for the species (see https://www.mvtimes.com/2020/10/05/katama-oyster-farm-gets-grant-grow-scallops/). Given the high farm-gate value of this crop and dwindling wild capture, the potential for aquaculture growth of the industry is extremely important. In this framework, identification of bay scallop stocks that better resist BSC and stressful temperature is a major priority for a broad range of stakeholders. Our expected results will optimize aquaculture efforts in the Northeast and facilitate the recovery of bay scallops in NY waters and will serve as a reference for establishing selective breeding programs across the region.

2.3. Proposed Methods and Activities

2.3.1. General design

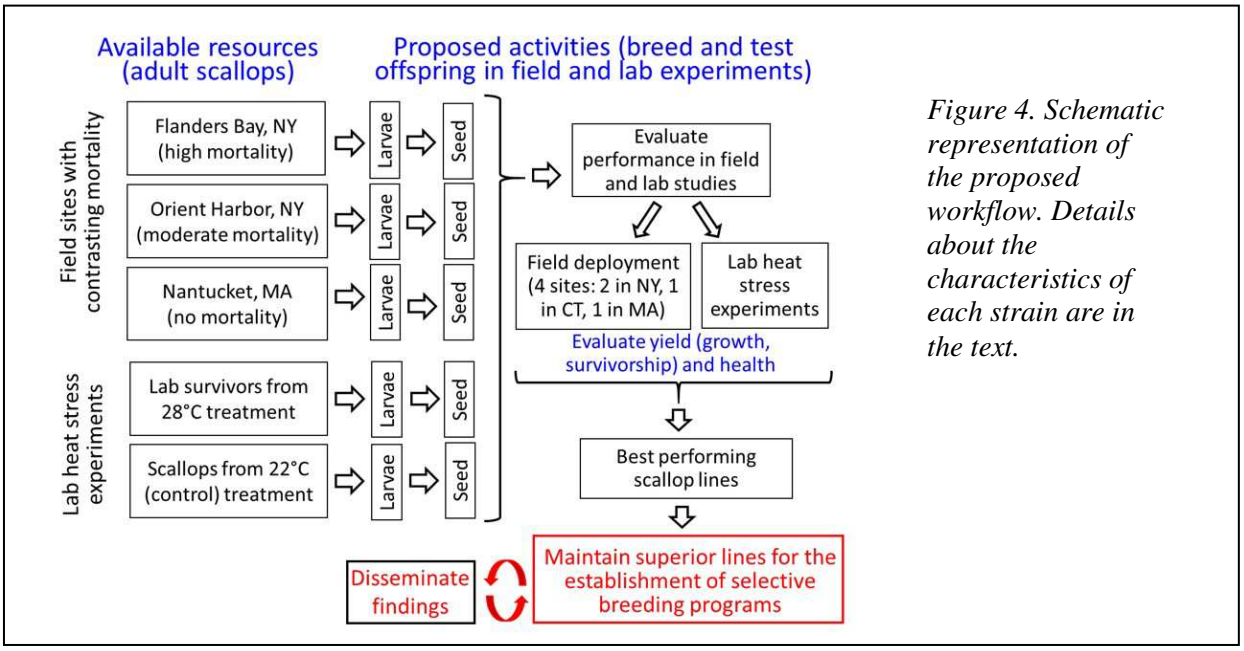

Figure 4. Schematic representation of the proposed workflow. Details about the characteristics of each strain are in the text.

The general design of the study is depicted in Figure 4. A total of 5 scallop groups will be separately bred. First, we will breed adult scallops from each of the following three stocks: 1) adults derived from an area that was extensively (>90% mortality) submitted to the epizootic mortality event (Flanders Bay, NY), 2) adults derived from an area that was mildly (40-50% mortality) submitted to the event (Orient Harbor, NY), and 3) adults from a control area that was not impacted by the epizootic mortality event (Martha's Vineyard, MA). Animals from each of these groups are currently available to us, but depending on the timeline of funding availability, a new sampling effort from the field may be warranted (in case funding is delayed and scallops currently available succumb to natural senescence). Two additional NY stocks derived from laboratory challenge experiments will also be bred. These include scallops that survive exposure to stressful temperature conditions (28°C), as well as scallops from a control treatment maintained at 22°C (see Figure 3 for an example of mortality trends generated during lab experiments). The aim of using these lab scallops is to see if temperature alone is sufficient to induce a selective heritable resistance. Adults from each of the five groups will be separately conditioned and spawned following industry standards (by co-PI Rivara, President of Aeros Cultured Oyster Company). Resulting seed will be separately deployed in the field (4 locations, 3

replicate cages/location) and performance (survivorship, disease development and yield) will be monitored for a total period of 18 months. Field sites will include 2 different locations in the Peconic Estuary (1 site that was severely impacted by the 2019 mortality event and 1 site that was mildly impacted), 1 location in Connecticut (growing scallop aquaculture, not known to be impacted by BSC or other unusual mortalities), and 1 location in Martha's Vineyard (important scallop aquaculture industry, not known to be impacted by BSC or by unusual mortalities). In parallel, scallops from each group will be used in laboratory challenge experiments to evaluate the resilience of the selectively-bred stocks to temperature stress. The premise is to be able to identify the most resilient line(s) and use this(these) as broodstock to produce scallops that are better able to resist BSC and withstand our changing environment. Identified superior lines will be maintained as broodstock for the initiation of a regional breeding program. Our extension and outreach efforts will target the diffusion of this new information to public stakeholders and to the industry.

2.3.2. Scallop conditioning and spawning

A minimum of 30 scallops from each of the groups (see Figure 4) will be acclimated and conditioned at the Aeros Oyster Company in Southold, NY, in early May 2021 under the supervision of co-PI Rivara who has been growing scallops for over a decade. Bay scallops will be spawned mid to late May 2021. Each group will be spawned separately to prevent accidental cross breeding of groups. Bay scallops, which are hermaphrodite, alternate the release of male and female gametes during spawning, sometimes several times. Gametes will be collected as the animal is spawning to prevent self fertilization during the spawning process. Gametes produced as the animal switches gamete release will be discarded. Scallops will be divided into two sub-groups during spawning. The male gametes from one sub group will be used to fertilize female gametes from the other subgroup. The total number of eggs will be counted for each group and equivalent numbers used for pooling. Fertilized eggs from each group will be pooled ~1 h post-fertilization and cultured as a group using industry-standard techniques. Larviculture will take place using 100L conical tanks, maintaining the different groups in separate tanks. Drain down screens used to collect larvae will be thoroughly cleaned and rinsed in between groups to prevent cross contamination. Larvae will be set in the hatchery and grown in floating set trays. Post set will be grown in land-based upwellers until large enough (ca. 5mm) to be placed in a floating nursery system where they will be held until at least 15mm before deployed in the field. The larvae and post-set will be thinned without size culling (to maintain genetic diversity) at each phase to prevent overcrowding.

2.3.3. Field grow-out

Juvenile scallops (~15mm, anticipated for ~August 2021) will be placed in lantern nets at each of four sites (2 in NY, 1 in each of CT and MA) using industry standard stocking rates (ca. 200/m^2 at harvest size). The 2 NY sites have displayed contrasting mortality levels in 2019 and 2020, while the CT (under the supervision of collaborator D.J. King) and MA (under the supervision of collaborator E. Green-Beach; see attached letters) sites represent active scallop aquaculture sites that did not show any known unusual mortalities in the last few decades. It is anticipated that all scallop lines will be available for deployment at the same time to ensure comparable culture conditions. Lantern nets and tiers within lantern nets assignment will follow a general randomized block design. Each site will host 5 lantern nets of 5 tiers each, allowing the deployment of each scallop line in a total of 5 tiers per site. Lantern nets will be monitored and maintained throughout the deployment period (July of Year 1 through October of Year 2). Scallop growth and survivorship will be evaluated in October of Year 1, and April and October

of Year 2. Pathology samples (detailed below) will be collected and processed in summer of Year 2 when BSC disease intensity is expected to peak. In parallel, environmental conditions (temperature and dissolved oxygen) will be monitored throughout the study period using HOBO loggers already available to the team (loggers accommodate 27,000 data points).

2.3.4. Temperature stress experiments

We will complement our field performance experiments with laboratory trials to evaluate the development of BSC infection and scallop mortality under controlled conditions. These lab investigations will allow us to segregate the specific effect of temperature stress on survivorship in our selectively-bred scallop lines. To do so, we will expose scallops (14 month old grown in an enzootic site in NY) from each of the 5 selectively-bred groups to the following temperatures: 22°C, 25°C and 28°C. As shown in Figure 3, these temperatures allow the evaluation of scallop performances under ecologically-relevant temperatures prevailing in late spring and early fall (22°C) or under optimal (25°C) or stressful (28°C) summer conditions. Scallops (3 replicate tanks/condition, 30 individuals/replicate) will be gradually acclimated from ambient conditions to target temperature levels (e.g. 1ºC increase every ~2 days) and will be monitored for disease development (see pathology testing below) and mortality over a period of ~2 months.

2.3.5. Pathology testing

We have a long experience collecting, monitoring and processing bivalve mollusks (Dahl *et al.* 2016; Liu *et al.* 2017; Hornstein *et al.* 2018), including wild and aquacultured scallops (Tettelbach & Wenczel 1993; Tettelbach *et al.* 1999, 2013, 2015), and we will follow our standard protocols to perform this work. Sampled scallops (30 individuals/scallop line/site/date, including lab experiments described in 2.3.4) will be measured, weighed and shucked. For each scallop, a section of soft tissues that include the adductor muscle, gills, mantle, digestive gland and the kidney will be fixed in formalin, embedded in paraffin, sectioned and mounted on a glass slide. This sampling effort will allow the detection of a minimum of 10% disease prevalence at 95% confidence level. Pathological analyses will rely on histological evaluations, which provide information on BSC prevalence and intensity but also on the occurrence of other pathogens that can affect growth and survivorship in bay scallops, including *Perkinsus*-like pathogens (i.e. formerly considered *P. karlssoni*), *Chlamydia* sp., *Rickettsia* sp., and haplosporidian-like parasites. BSC disease intensity and severity will be ranked based on the number of BSC cells/section (absent, low, moderate, heavy) and the extent of kidney lesions (absent, light, moderate, extensive), respectively. Tissue samples (kidney, adductor muscle) will also be preserved for future investigations to contrast the genomic make-up of resistant scallop to that of susceptible individuals (follow-up investigations to this seed proposal).

2.3.6. Extension and Outreach

The research team includes public (E. Green-Beach, R. Karney) and private (K. Rivara, D.J. King) farmers as well as personnel at the Cornell Cooperative Extension (CCE) of Suffolk County (S. Tettelbach, S. Hughes), a non-profit community education agency that is part of the national cooperative extension system whose mission is promote the economic health of farmers and fishermen. Although this project represents a “proof-of-concept” seed application, our team will directly involve industry members and findings will be shared by the industry. Tettelbach, through extension programs already existing at CCE, will coordinate the extension and professional educational programs of the team. The bay scallop is State Shell of New York and the current decline in scallop populations has brought significant news coverage in the whole

region. A direct outcome of this research is the identification of superior scallop stocks suitable for both public enhancement programs and private farming activities. We will employ various methods to connect with stakeholders and the aquaculture industry to extend research findings (e.g. ability to select scallop for heat tolerance and BSC resistance). Activities under this program will work towards sharing information about the best strain(s) with farmers in the region. For example, Allam is a contributor to **a shellfish aquaculture e-course** (that includes information on regulatory, environmental and biological aspects of shellfish culture in NY) for growers, and findings from the current research will be integrated into that course. Extension and outreach activities will also include presentations at meetings usually attended by the industry such as the National Shellfisheries Association Annual Meeting, the Milford Aquaculture Seminar and the Northeast Aquaculture Conference and Expo (NACE). We will also communicate our results to local user groups in the Northeast through local industry meetings (for example the Long Island Shellfish Growers meeting). Summaries of the research activities and findings will be distributed through the regional extension network that already exists, and placed on the websites of the MADL, Cornell Cooperative Extension and the East Coast Shellfish Growers Association (co-PI Rivara is current President of ECSGA). We acknowledge however that this seed grant application does not include the resources to develop a comprehensive extension program. Nevertheless, the findings are expected to serve as the basis for the future development (future grant applications) of a regional bay scallop selective breeding program which will involve significant extension activities.

2.3.7. Roles and responsibilities of Personnel

Our regional team builds on ongoing and new collaborations and integrates scientists and farmers from three Northeastern states (MA, CT and NY), and has expertise in all areas relevant to the successful completion of this project (see attached CVs). The lead PI (Pales Espinosa) is a shellfish ecophysiologist with a long expertise on various aspects of bivalve physiology and health and serves as co-PI on a regional hard clam selective breeding initiative recently funded by NOAA. She will coordinate the research between the different partners and will supervise the laboratory challenge experiments. Allam is a shellfish pathologist with extensive experience in bivalve pathology, physiology and genomics. He manages the Marine Animal Disease Laboratory (http://you.stonybrook.edu/madl) at Stony Brook University and has been closely working with Pales Espinosa on different aspects of shellfish aquaculture and health. He will be in charge of all diagnostic activities associated with the project. Through his endowed professorship, Allam has access to discretionary funds that can be used as needed to complement the resources provided by NRAC to perform the activities described in this seed application. Tettelbach is a shellfish ecologist and educator and has over 40 years of research experience on bay scallops. He will serve as coordinator of field activities (scallop sampling, environmental monitoring) in New York and, along with Scott Hughes of CCE, will participate fully in all fieldwork and spearhead extension activities performed via Cornell Cooperative Extension. Rivara is the President of Aeros Oyster Co. and current President of the East Coast Shellfish Growers Association. She has been producing scallop seeds for commercial and public farmers since 2007. She will be in charge of all scallop breeding activities described in this project. Green-Beach is the Director of the Martha's Vineyard Shellfish Group, Inc. She has nearly 15 years of bivalve hatchery experience, and broad knowledge of local shellfish grow-out techniques. She will coordinate bay scallop deployment in MA. Karney is the previous director (currently serves as Director Emeritus) of Martha's Vineyard Shellfish Group, Inc. and has an extensive experience with the culture of bay scallops and a broad range of bivalve species. He will assist Green-Beach in an advisory capacity in all aspects of the field grow-out trials. King is

a farmer based in Branford, CT, and has been growing shellfish over the last two decades with an increasing contribution of bay scallops to the production in recent years. He will supervise scallop deployment and monitoring on his farm grounds in CT. His staff will assist with all phases of field work, including collection of samples for growth and pathology work as well as mortality assessment. Our research team members and industry partners have all required permits and licenses to grow, collect or possess bay scallops.

2.4. Anticipated Products/Outcome

Our proposed research has major implications for basic and applied science. This would be the first study to demonstrate the ability to selectively breed bay scallops for heat tolerance and disease resistance. A direct outcome of this proposed work is the identification of scallop stocks that resist temperature stress and BSC infections, making the species an appealing product for culture in many protected shallow embayments throughout the region. Given the very rapid growth rate of the species and the high farm-gate value of the product, we believe that there is significant potential for the development of a robust industry similar to that of other scallop species worldwide. In fact, there is a growing interest in aquaculture product diversification among oyster growers, and bay scallop aquaculture provides protection from market fluctuation since the product can be frozen without significant loss to its value (as opposed to oysters). For these reasons, interest in bay scallop aquaculture is increasing as demonstrated by the new initiative implemented in MA in support of bay scallop aquaculture (https://www.mvtimes.com/2020/10/05/katama-oyster-farm-gets-grant-grow-scallops/). The ability to breed scallops that resist BSC and temperature stress will also facilitate the enhancement and restoration of bay scallop resources in the region. Information on these superior lines will be widely disseminated through our extension and outreach plan. The maintenance of superior bay scallop strains identified in the project will be done at Aeros Cultured Oyster Company (co-PI Rivara) and the new experimental shellfish hatchery built at Stony Brook University (PI Pales Espinosa and co-PI Allam) and will serve for the establishment of a regional selective breeding program for bay scallops. Our expected results will facilitate the growth of the bay scallop aquaculture industry and will serve as a reference for future studies elsewhere, including in other species challenged by disease and/or environmental stress.

2.5. Project Schedule

Although we envision this as a seed project, the proposed total duration is 24 months (with a start date of March 1, 2021) to allow sufficient time to evaluate the performance of produced offspring over a scallop's commercial lifetime. This is particularly necessary since field observations showed that disease intensity and mortality are significantly worse for adult, market-size, scallops as compared to juveniles (second summer of a scallop's life cycle). The below table is our projected timeline:

	YEAR 1 (Mar 2021 - Feb 2022)												YEAR 2 (Mar 2022 - Feb 2023)											
ACTIVITY	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Project initiation meeting	✓																							
Building of experimental gear	✓	✓																						
Conditionning, spawning and rearing of scallops			✓	✓	✓	✓																		
Field deployment and monitoring						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Lab temperature challenge																✓	✓	✓	✓	✓				
Pathology testing (BSC, other conditions)																	✓	✓	✓	✓				
Extension and outreach																						✓	✓	✓
Broodstock maintenance and distribution																					✓	✓	✓	✓
Inclusive data analysis and publications																				✓	✓	✓	✓	✓

2.6. Supporting Facilities

PIs Pales Espinosa and Allam: The bulk of the analytical activities at Stony Brook University will be performed at the Marine Animal Disease Laboratory (MADL, you.stonybrook.edu/madl). This facility is the reference lab for the state of NY for shellfish diseases and includes a temperature-controlled wet laboratory (~450 sq ft equipped for bivalve husbandry) and 3 dry labs (1450 sq ft) equipped for physiological, cell, and molecular biology studies. Major equipment include: 4-color FACScalibur flow cytometer, BioRad BioLogic FPLC, plate reader (PE Wallac Victor 2), Dynatech spectrophotometer, Nanodrop ND1000 spectrophotometer, quantitative PCR (ABI QuantStudio 6), 3 Gradient thermal cyclers, and gel electrophoresis equipment. MADL is also outfitted with Nikon microscopy equipment including 1 inverted (Eclipse TE-2000S) and 1 upright (Eclipse TE-200) compound microscopes with digital image capture and analysis. The laboratory has also equipment for cell and parasite cultures (biosafety cabinet, 4 incubators), as well as sample processing and storage (3 centrifuges, 1 cytospin, two chemical hoods, 4 refrigerators, three -20° C and two 25 cu ft -80° C freezers). Our school also operates the Flax Pond Marine Laboratory that we regularly use for large-scale experiments. This facility has a total of 7800 sq ft of space, including dry labs, offices and three large wet labs. A thorough renovation of the Flax Pond Lab has recently been completed to establish the first shellfish hatchery and nursery operated by the State University of New York. This was in response to an initiative spearheaded by the NYS Governor to reinvigorate shellfish aquaculture in the state. The facility, together with Aeros Oyster Co. and CCE's hatchery in Southold, will be used to secure and maintain the superior bay scallop line(s) identified in this study.

PI Tettelbach: Fieldwork for the New York component of this project will be based out of the Suffolk County Marine Environmental Learning Center of Cornell Cooperative Extension (http://ccesuffolk.org/marine), located in Southold, NY. The lab has 3 shellfish hatcheries, state of the art microalgal rearing systems, as well as land-based and floating upweller nursery systems. Fieldwork is conducted from the lab's 21' Parker, which can easily access all field sites as the lab is situated near the center of the Peconic Bays. All necessary dive equipment (dive compressor, Scuba tanks) and diving supplies are already in place here.

PI Rivara: Bay scallops will be cultivated for the project at the Aeros Cultured Oyster Company hatchery and nursery facility in Southold, NY at the Peconic Land Trust Shellfisher Preserve. The facility operates its hatchery from December - July annually producing Eastern oysters, hard clams (quahogs) and bay scallops primarily for commercial shellfish farmers. Aeros has the cultivation capacity to produce approximately 20 million larvae and an average of 5-6 million post-set per spawn. The site has both land based upweller and floating upweller systems (FLUPSY's). Aeros also operates FLUPSYs in South Jamesport and Greenport, NY. Aeros also

has floating culture bags for holding seed such as bay scallops, that perform best in this type of system. Aeros habitually separates batches of shellfish to develop separate broodstock lines with distinct characteristics such as disease resistance, growth and shell shape. The owner and management staff are capable of labelling, separating, monitoring and maintaining groups of shellfish to segregate individual characteristics.

PI Green-Beach:
The field work in MA will be coordinated and supervised by the Martha's Vineyard Shellfish Group (MVSG). Since 1976, MVSG has conducted a successful community-based shellfish management program that has concentrated on the development and application of hatchery and field aquaculture methods for public shellfish stock enhancement including the operation of the nation's first public solar shellfish hatchery. MVSG has productive and intimate relationships with the shellfish departments of each municipality on Martha's Vineyard, and thus has access to additional expertise, field support and growing areas. MVSG partners with the local departments, ever year, to grow millions of bay scallops and other bivalves in the hatchery and in field nurseries.

Partners Karney and King:
Karney will be available in a consulting capacity to provide his expertise and assist as needed in handling the scallops prior to deployment, during the field trial grow-out and final sampling. The scallops in the grow-out trials will be held prior to deployment in flowing seawater at either of the two MVSG hatcheries. Likewise, samples will be processed and prepared for shipment from either of these two wetlabs. Similarly, King will supervise scallop deployment and monitoring on his farm grounds in CT. His company owns and operates the Kori Alexander commercial fishing vessel. His staff will assist with all phases of field work, including collection of samples for growth and pathology work as well as mortality assessment.

Cited References

Arnold WS, Blake NJ, Harrison MM, Marelli DC, Parker ML, Peters SC, Sweat DE (2005). Restoration of bay scallop (Argopecten irradians Lamarck) populations in Florida coastal waters: planting techniques and the growth, mortality and reproductive development of planted scallops. J Shellfish Res 24: 883−904.

Arnold WS, Marelli DC, Bray CP, Harrison MH (1998). Recruitment of bay scallops Argopecten irradians in Floridian Gulf of Mexico waters: scales of coherence. Mar Ecol Prog Ser 170: 43−157.

Baker S, Scarpa J, Sturmer L (2011). Selection for heat tolerance in clams using biomarkers. Presented at the 2011 Clam Industry Workshop, Cedar Key, FL.

Beattie JH, Chew KK, Hershberger WK (1980). Differential survival of selected strains of Pacific oysters (Crassostrea gigas) during summer mortality. Proceedings National Shellfisheries Association 70: 184–189.

Belding DL (1910). The scallop fishery of Massachusetts, including an account of the natural history of the common scallop. Marine Fisheries Series No. 3, Division of Fisheries and Game, Department of Conservation, Commonwealth of Massachusetts, Boston, MA. 51 pp

Bricelj VM, Epp J, Malouf RE (1987). Intraspecific variation in reproductive and somatic growth cycles of bay scallops Argopecten irradians. Mar Ecol Prog Ser 36: 123−137.

Burreson EM (1991). Effects of Perkinsus marinus infection in the eastern oyster, Crassostrea virginica: I. Susceptibility of native and MSX-resistant stocks. Journal of Shellfish Research 10: 417–423.

Carroll JM, Furman BT, Tettelbach ST, Peterson BJ (2012). Balancing the edge effects budget: bay scallop settlement and loss along a seagrass edge. Ecology 93:1637−1647.

Cheng D, Liu H, Zhang H, Tan KS, Ye T, Li S et al. (2019). Differential expression of HSP70 gene between golden and brown noble scallops Chlamys nobilis under heat stress and bacterial challenge. Fish and Shellfish Immunology 94: 924–933.

Clarke Jr AH (1965). The scallop superspecies Aequipecten irradians (Lamarck). Malacologia 2:161-188.

Cosper EM, Dennison WC, Carpenter EJ, Bricelj VM, Mitchell JG, Kuenstner SH, Colflesh D, Dewey M (1987). Recurrent and persistent brown tide blooms perturb coastal marine ecosystem. Estuaries 10: 284−290.

Dahl S, Allam B (2016). Clam transplant as a mitigation strategy for QPX disease in Mercenaria mercenaria. Aquaculture Research 47: 3445-1454.

Dahl, S.F., Perrigault M., Allam, B. (2008). Laboratory transmission studies of QPX disease in the hard clam: Pathogenicity of different pathogen isolates toward various clam stocks. Aquaculture 280: 64-70.

Degremont L, Bedier E, Soletchnik P, Ropert M, Huvet A, Moal J et al. (2005). Relative importance of family, site, and field placement timing on survival, growth and yield of hatchery-produced Pacific oyster spat (Crassostrea gigas). Aquaculture249: 213–229.

Degremont L, Ernande B, Bedier E, Boudry P (2007). Summer mortality of hatchery-produced Pacific oyster spat (Crassostrea gigas). I. Estimation of genetic parameters for survival and growth. Aquaculture 262: 41–53.

Degremont L, Bedier E, Boudry P (2010). Summer mortality of hatchery-produced Pacific oyster spat (Crassostrea gigas). II. Response to selection for survival and its influence on growth and yield. Aquaculture 299: 21–29.

Degremont L, Nourry M, Maurouard E (2015a). Mass selection for survival and resistance to OsHV-1 infection in Crassostrea gigas spat in field conditions: response to selection after four generations. Aquaculture 446: 111–121.

Degremont L, Lamy JB, Pepin JF, Travers MA, Renault T (2015b). New insight for the genetic evaluation of resistance to ostreid herpesvirus infection, a worldwide disease. Crassostrea gigas. PlosOne 10(6): e0127917.

de Melo CMR, Durland E, Langdon C (2016). Improvements indesirable traits of the Pacific oyster, Crassostrea gigas, as a result of five generations of selection on the West Coast, USA. Aquaculture 460: 105–115.

Dove MC, Nell JA, O'Connor WA (2013). Evaluation of the progeny of the fourth-generation Sydney rock oyster Saccostrea glomerata (Gould, 1850) breeding lines for resistance to QX disease (Marteilia sydneyi) and winter mortality (Bonamia roughleyi). Aquaculture Research 44(11): 1791-1800.

Farhat S, Tanguy A, Pales Espinosa E, Guo X, Boutet I, Smolowitz R, Murphy D, Rivara G, Allam B (2020). Identification of variants associated with hard clam, Mercenaria mercenaria, resistance to Quahog Parasite Unknown disease. Genomics 112(6): 4887-4896.

Farley CA, Lewis EJ, Relyea D, Zahtila J (1995). Studies of resistance in progeny of brood stock selected from juvenile oyster disease (JOD) survivors. Journal of Shellfish Research 14: 242.

Farley CA, Lewis EJ, Relyea D, Zahtila J, Rivara G (1996). Resistance studies for juvenile oyster disease (JOD); 1995 continuation. Journal of Shellfish Research 15: 453.

Farley CA, Lewis EJ, Relyea D, Zahtila J, Rivara G (1997). Juvenile oyster disease resistance studies continued: 1994–1996. Journal of Shellfish Research 16: 286.

Fitzer SC, McGill RA, Torres Gabarda S, Hughes B, Dove M, O'Connor W, Byrne M (2019). Selectively bred oysters can alter their biomineralization pathways, promoting resilience to environmental acidification. Global change biology, 25(12), 4105-4115.

Ford SE, Haskin HH (1987). Infection and mortality patterns in strains of oysters Crassostrea virginica selected for resistance to the parasite Haplosporidium nelsoni (MSX). Journal of Para-sitology 73: 368–376.

Frank-Lawale A, Allen SK, Degremont L (2014). Breeding and domestication of Eastern oyster (Crassostrea virginica) lines for culture in the mid-Atlantic, USA: line development and mass selection for disease resistance. Journal of Shellfish Research 33: 153–165.

Garcia-Esquivel Z, Bricelj VM (1993). Ontogenetic changes in microhabitat distribution of juvenile bay scallops, Argopecten irradians irradians (L.), in eelgrass beds, and their potential significance to early recruitment. Biol Bull 185: 42–55.

Guo X, Luo Y (2006). Scallop culture in China. In: Shumway S, Parsons J (eds) Scallops: Biology, Ecology and Aquaculture, 2nd ed. Developments in Aquaculture and Fisheries Science, Vol 35. Elsevier, Amsterdam, Boston, Heidelberg, pp 1143–1161.

Hershberger WK, Perdue JA, Beattie JH (1984). Genetic selection and systematic breeding in Pacific oyster culture. Aquaculture39: 237–245.

Hornstein J, Pales Espinosa E, Cerrato R, Lwiza K, Allam B (2018). The influence of temperature stress on the physiology of the Atlantic surfclam, Spisula solidissima. Comparative Biochemistry and Physiology Part A 222: 66-73.

Kahn J, Rockel M (1988). Measuring the economic effects of brown tides. J Shellfish Res 7: 677-682.

Kosaka Y, Ito H (2006). Japan. In: Shumway S, Parsons J (eds) Scallops: Biology, Ecology and Aquaculture, 2nd ed. Developments in Aquaculture and Fisheries Science, Vol 35. Elsevier, Amsterdam, Boston, Heidelberg, pp 1093–1141.

Krause MK (1992) Use of genetic markers to evaluate the success of transplanted bay scallops. J Shellfish Res 11: 199.

Kube PD, Cunningham M, Dominik S, Parkinson S, Henshall J, Finn B et al. (2011). Enhancement of the Pacific oyster Selective Breeding Program. CSIRO Marine; Atmospheric

Research, Australian Seafood Industries P/L, Seafood CRC; Fisheries Research; Development Corporation (FRDC), Hobart, TAS.

Levitan DR, Petersen C (1995). Sperm limitation in the sea. Trends Ecol Evol 10: 228–231

Liermann M, Hilborn R (2001). Depensation: evidence, models and implications. Fish and Fisheries 2: 33-58.

Liu Q, Collier JL, Allam B (2017). Seasonality of QPX disease in the Raritan Bay (NY) wild hard clam (Mercenaria mercenaria) population. Aquaculture Research 48: 1269-1278.

MacKenzie CJ (2008). The bay scallop, Argopecten irradians, Massachusetts through North Carolina: its biology and the history of its habitats and fisheries. Mar Fish Rev 70: 6–79.

Marelli DC, Arnold WS, Bray C (1999). Levels of recruitment and adult abundance in a collapsed population of bay scallops (Argopecten irradians) in Florida. J Shellfish Res 18: 393–399.

McCarty A J, McFarland K, Small J, Allen Jr SK, Plough LV (2020). Heritability of acute low salinity survival in the Eastern oyster (Crassostrea virginica). Aquaculture, 529, 735649.

Naciri-Graven Y, Martin AG, Baud JP, Renault T, Gérard A (1998). Selecting the flat oyster Ostrea edulis (L.) for survival when infected with the parasite Bonamia ostreae. Journal of Experimental Marine Biology and Ecology 224.1 91-107.

Nell JA, Sheridan AK, Smith IR (1996). Progress in a Sydney rock oyster Saccostrea commercialis (Iredale and Roughley) breeding program. Aquaculture 144: 295–302.

NYSDEC (New York State Department of Environmental Conservation) (2011) Annual Commercial shellfish landings for New York state, 1946–2019, NYSDEC, East Setauket, NY.

Parker LM, Ross PM, O'Connor WA (2011). Populations of the Sydney rock oyster, Saccostrea glomerata, vary in response to ocean acidification. Marine Biology, 158(3), 689-697.

Parker LM, O'Connor WA, Raftos DA, Portner H-O, Ross PM (2015). Persistence of positive carryover effects in the oyster, Saccostrea glomerata, following transgenerational exposure to ocean acidification. PLoS One 10: e0132276.

Perdue JA, Beattie JH, Chew KK (1981). Some relationships between gametogenic cycle and summer mortality phenomenon in the Pacific oyster (Crassostrea gigas) in Washington State. Journal of Shellfish Research 1: 9–16.

Peterson CH, Summerson HC (1992). Basin-scale coherence of population dynamics of an exploited marine invertebrate, the bay scallop: implications of recruitment limitation. Mar Ecol Prog Ser 90: 257–272.

Peterson CH, Summerson HC, Luettich RA Jr (1996). Response of bay scallops to spawner transplants: a test of recruitment limitation. Mar Ecol Prog Ser 132: 93–107.

Ragone Calvo LMR, Calvo GW, Burreson EM (2003). Dual dis-ease resistance in a selectively bred eastern oyster, Crassostrea virginica, strain tested in Chesapeake Bay. Aquaculture 220: 69–87.

Rose JC (1987). Scallops transplanted to algae-damaged beds. Oceans 20(1):6.

Summerson HC, Peterson CH (1990). Recruitment failure of the bay scallop, Argopecten irradians concentricus, during the first red tide, Ptychodiscus brevis, outbreak recorded in North Carolina. Estuaries 13: 322–331.

Tan K, Zhang H, & Zheng H (2020). Selective breeding of edible bivalves and its implication of global climate change. Reviews in Aquaculture. In Press. DOI: 10.1111/raq.12458

Tettelbach ST (1986). Dynamics of crustacean predation on the northern bay scallop, Argopecten irradians irradians. PhD dissertation, University of Connecticut, Storrs, CT.

Tettelbach ST (1991). Seasonal changes in a population of northern bay scallops, Argopecten irradians irradians. pp. 164-175 In: Shumway SE, Sandifer PA (eds.) An International

Compendium of Scallop Biology and Culture. World Aquacult Soc Publ, Baton Rouge, LA.

Tettelbach ST, Barnes D, Aldred J, Rivara G, Bonal D, Weinstock A, Fitzsimons-Diaz C, Thiel J, Cammarota MC, Stark A, Wejnert K, Ames R, Carroll J (2011). Utility of high density plantings in bay scallop, Argopecten irradians irradians, restoration. Aquacult Int 19: 715-739.

Tettelbach ST, Peterson BJ, Carroll JM, Furman BT, Hughes SWT, Havelin J, Europe JR, Bonal DM, Weinstock AJ, Smith CF (2015). Aspiring to an altered stable state: rebuilding of bay scallop populations and fisheries following intensive restoration. Mar Ecol Prog Ser 529: 121-136.

Tettelbach ST, Peterson BJ, Carroll JM, Hughes SWT, Bonal DM, Weinstock AJ, Europe JR, Furman BT, Smith CF (2013). Priming the larval pump: resurgence of bay scallop recruitment following initiation of intensive restoration efforts. Mar Ecol Prog Ser 478:1 53-172.

Tettelbach ST, Smith CF (2009). Bay scallop restoration in New York. Ecol Rest 27: 20–22.

Tettelbach ST, Smith CF, Smolowitz R, Tetrault K, Dumais S (1999). Evidence for fall spawning of northern bay scallops, Argopecten irradians irradians (Lamarck, 1819), in New York. J Shellfish Res 18: 47–58.

Tettelbach ST, Wenczel P (1993). Reseeding efforts and the status of bay scallop Argopecten irradians (Lamarck, 1819) populations in New York following the appearance of 'brown tide' algal blooms. J Shellfish Res 12: 423–431.

Thompson EL, O'Connor W, Parker L, Ross P, Raftos DA (2015). Differential proteomic response of selectively bred and wild-type Sydney rock oyster populations exposed to elevated CO2. Molecular Ecology 24(6): 1248–1262.

Thomsen J, Stapp LS, Haynert K, Schade H, Danelli M, LanningG et al. (2017). Naturally acidified habitat selects for ocean acidification-tolerant mussels. Science Advances 3(4):e1602411.

Turner WH (1995) 'Bags to drags', the bay scallop restoration project in the Westport River, a two-year update. J Shellfish Res 14: 249.

USGS (United States Geological Survey (2020) USGS 01304562 Peconic River at County Hwy 105 at Riverhead, NY. https://waterdata.usgs.gov/nwis/uv?site_no=01304562

Wang K, Pales Espinosa E, Tanguy A, Allam B (2016). Alterations of the immune transcriptome in resistant and susceptible hard clams (Mercenaria mercenaria) in response to Quahog Parasite Unknown (QPX) and temperature. Fish and Shellfish Immunology 49: 163-176.

Wang Q, Li S, Fu C, Zhang M, Teng W, Liu Z, Liu W, Li W, & Tan K (2014). Establishment of high temperature resistance families and use of laboratory assays to predict subsequent survival in juvenile stage of the Japanese scallop (Mizuhopecten yessoensis). Journal of Fisheries of China, 38(3), 371-377.

Ward RD, Thompson PA, Appleyard SA, Swan AA, Kube PD (2005). Sustainable genetic improvement of Pacific oysters in Tasmania and South Australia. Fisheries Research and Development Corporation final report, Canberra, ACT.

Zheng HP, Liu HL, Chen XQ, Zhang B, Zhang Q, Wang YJ et al. (2015). A new variety "Nan'ao Golden Scallop" of the noble scallop Chlamys nobilis (Bivalve: Pectinidae). In: National Aquaculture Technique Extension Central Station of China (eds) Guide for Extending Aquatic Varieties, pp. 123–132. Beijing: Chinese Agricultural Press.

Zheng HP, Liu HL, Liu WH, Sun ZW, Zhang Q (2012b). Changes of total carotenoid and lipid content in scallop tissues of Chlamys nobilis (Bivalve: Pectinidae) during gonad maturation. Aquaculture 342–343: 7–12.

Zheng HP, Sun ZW, Zhang T, Liu WH, Liu HL (2012a). Inheritance of shell colors in the noble scallop Chlamys nobilis (Bivalve: Pectinidae). Aquaculture Research 44: 1229–1235.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year 1)

ORGANIZATION AND ADDRESS The Research Foundation of State University of New York				USDA AWARD NO.			
PROJECT DIRECTOR(S) Emmanuelle Pales Espinosa and collaborators				DURATION PROPOSED MONTHS: **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer				
a. ___2_ (Co)-PD(s)	0.5			3670			
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. __1__Graduate Students.....				7250			
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →				10920			
B. Fringe Benefits (If charged as Direct Costs)				3278			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				14198			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				1500			
F. Travel				500			
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				13750			
K. Total Direct Costs (C through J)..... →				29948			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				29948			
N. Other..... →							
O. Total Amount of This Request..... →				29948			
P. Carryover -- (If Applicable)Federal Funds: $	**Non-Federal funds: $**		**Total $**				
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party)** →							
- Non Cash Contributions (both Applicant and Third Party)							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Emmanuelle Pales Espinosa, Research Associate Professor							
Authorized Organizational Representative							

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year 2)

ORGANIZATION AND ADDRESS The Research Foundation of State University of New York				USDA AWARD NO.			
PROJECT DIRECTOR(S) Emmanuelle Pales Espinosa and collaborators				DURATION PROPOSED MONTHS: _____ **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer				
a. __2__ (Co)-PD(s)	0.5			3670			
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. __1__Graduate Students.....				7250			
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →				10920			
B. Fringe Benefits (If charged as Direct Costs)				3327			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				14247			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				1500			
F. Travel				500			
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				23770			
K. Total Direct Costs (C through J)..... →				40017			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				40017			
N. Other..... →							
O. Total Amount of This Request..... →				40017			
P. Carryover -- (If Applicable)Federal Funds: $	**Non-Federal funds: $**		**Total $**				
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party) →**							
- Non Cash Contributions (both Applicant and Third Party)							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Emmanuelle Pales Espinosa, Research Associate Professor							
Authorized Organizational Representative							

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year T)

ORGANIZATION AND ADDRESS The Research Foundation of State University of New York				USDA AWARD NO.			
PROJECT DIRECTOR(S) Emmanuelle Pales Espinosa and collaborators				DURATION PROPOSED MONTHS: _____ **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer				
a. __2__ (Co)-PD(s)	1			7340			
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. ____ Other Professionals.....							
c. ____ Paraprofessionals.....							
d. __1__ Graduate Students.....				14500			
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →				21840			
B. Fringe Benefits (If charged as Direct Costs)				6605			
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				28445			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies				3000			
F. Travel				1000			
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				37520			
K. Total Direct Costs (C through J)..... →				69965			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				69965			
N. Other..... →							
O. Total Amount of This Request..... →				69965			
P. Carryover -- (If Applicable)Federal Funds: $	**Non-Federal funds: $**		**Total $**				
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party) →**							
- Non Cash Contributions (both Applicant and Third Party)							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Emmanuelle Pales Espinosa, Research Associate Professor							
Authorized Organizational Representative							

BUDGET JUSTIFICATION

A. Salaries and Wages

A.1.a. Principal and Co-Principal Investigators: Salaries are based on current rates at Stony Brook University (SBU) and will remain unchanged throughout the duration of the project. PI Pales Espinosa is a Research Associate Professor and derives her full salary from research grants. She is asking for 2 weeks ($3,670) of support per year to supervise and participate in all aspects of the work, particularly coordination of field work, scallop breeding and pathology.

A.2.d. Graduate student: Partial support (3 months, equating $7,250 per year) is requested for 1 graduate student to assist with field work and pathology sample processing.

B. Fringe Benefits: In accordance with Stony Brook University projections, fringes on Pales Espinosa salary is calculated at a rate of 57.71% and 59.04% for Year 1 and Year 2, respectively. The fringe rate for the graduate student is 16%.

E. Expendable Supplies and Equipment: Our research group currently has all major equipment needed to perform proposed experiments. In each year, funds ($1,500/year) are requested to purchase field deployment supplies (data loggers, lantern nets, lines, anchors) as well as plasticware and fixative solutions needed to process pathology samples.

F. Travel: Funds ($500 per year) are requested to partially support the expenses of car travel (mileage, etc.) to deployment sites in all 3 states.

J. All Other Direct Costs: This section covers expenses incurred by collaborators that are external to Stony Brook University (see supportive documents) for seed production, field support and technical services for seed health certification and for pathology testing, as follows:

Consultant services: In Year 1, funds ($10,000) are requested to cover for hatchery and nursery services offered by Karen Rivara from Aeros Oyster Company. Rivara will produce experimental scallop lines and maintain identified superior stocks at the end of the project and mediate the diffusion of these stocks to interested hatcheries. Additional funds ($3,000 in Year 2; $1,500 for each partner) are requested to pay collaborating growers (Martha's Vineyard Shellfish Group, Inc., MA, and Donald J. King Lobsters, CT) to monitor scallop deployment devices and help with the deployment and collection of scallop samples.

Sub-awards: A sub-award is budgeted for Cornell Cooperative Extension, NY (co-PI Steve Tettelbach; $4,770 in Year 2, see attached supporting documents) to perform the deployment, monitoring and collection of scallops deployed in the two NY field sites. No sub-awards are established for our MA and CT colleagues since we expect to work directly with our partners in these states for scallop monitoring and collection (expenses covered above under "Consultant services").

Technical services: Funds are requested to cover for scallop seed health certification ($3,750 in Year 1) and for pathology testing of scallops ($16,000 in Year 2).

L. Indirect costs: IDC are not allowed by the funding agency.

Development of resistant bay scallop strains for aquaculture in the Northeast

Stephen Tettelbach and Scott Hughes - Cornell Cooperative Extension Marine Program

Scope of Work

We will conduct field plantings and subsequent monitoring of 5 groups of scallops bred for resistance to Bay Scallop Coccidian (BSC) disease and high water temperature at 2 sites in the Peconic Estuary, New York: one that was severely impacted by disease in 2019 and 2020 and one that was mildly impacted. Seed scallops will be deployed in 3 replicate lantern nets at each site in August 2021, then monitored for survival, disease development and overall yield at three time points: Fall 2021, late Spring 2022 and Fall 2022. The performance of these scallop lines will be then evaluated to determine the best stock(s) to use as broodstock for the establishment of a bay scallop selective breeding program for aquaculture and restoration. We will also do outreach and educational activities to transmit acquired information to local stakeholders (aquaculturists, baymen, managers) and regional/national interests through presentations, meetings and publications.

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year 1)

ORGANIZATION AND ADDRESS Cornell Cooperative Extension of Suffolk County, 3690 Cedar Beach Rd, Southold, NY				USDA AWARD NO.			
PROJECT DIRECTOR(S) Stephen Tettelbach				DURATION PROPOSED MONTHS: **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer				
a. ____ (Co)-PD(s)				0			
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. ____ Other Professionals.....				0			
c. ____ Paraprofessionals.....							
d. ____ Graduate Students.....							
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →							
B. Fringe Benefits (If charged as Direct Costs)							
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →							
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies							
F. Travel							
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)							
K. Total Direct Costs (C through J)..... →							
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →							
N. Other..... →							
O. Total Amount of This Request..... →				0			
P. Carryover -- (If Applicable)Federal Funds: $ **Non-Federal funds: $** **Total $**							
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party)** → **- Non Cash Contributions (both Applicant and Third Party)**							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Stephen Tettelbach, Shellfish Ecologist							
Authorized Organizational Representative							

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year 2)

ORGANIZATION AND ADDRESS Cornell Cooperative Extension of Suffolk County, 3690 Cedar Beach Rd, Southold, NY				USDA AWARD NO.			
PROJECT DIRECTOR(S) Stephen Tettelbach				DURATION PROPOSED MONTHS: _____ **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer				
a. __1__ (Co)-PD(s)	0.17			2060			
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. __1__ Other Professionals.....	0.17			960			
c. ____ Paraprofessionals.....							
d. ___ Graduate Students.....							
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →				3020			
B. Fringe Benefits (If charged as Direct Costs)							
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				3020			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies							
F. Travel							
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				1750			
K. Total Direct Costs (C through J)..... →				4770			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				4770			
N. Other..... →							
O. Total Amount of This Request..... →				4770			
P. Carryover -- (If Applicable)Federal Funds: $	**Non-Federal funds: $**		**Total $**				
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party) →**							
- Non Cash Contributions (both Applicant and Third Party)							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Stephen Tettelbach, Shellfish Ecologist							
Authorized Organizational Representative							

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039

BUDGET (Year T)

ORGANIZATION AND ADDRESS Cornell Cooperative Extension of Suffolk County, 3690 Cedar Beach Rd, Southold, NY				USDA AWARD NO.			
PROJECT DIRECTOR(S) Stephen Tettelbach				DURATION PROPOSED MONTHS: _____ **Funds Requested by Proposer**	DURATION PROPOSED MONTHS: _____ **Funds Approved by NIFA** (If different)	Non-Federal Proposed Cost-Sharing/ Matching Funds (If required)	Non-federal Cost-Sharing/Matching Funds Approved by NIFA (If Different)
A. Salaries and Wages.....	**CSREES-FUNDED WORK MONTHS**						
1. No. Of Senior Personnel	Calendar	Academic	Summer	2060			
a. __1__ (Co)-PD(s)	0.17						
b. ____ Senior Associates							
2. No. of Other Personnel (Non-Faculty) a. _____ Research Associates/Postdoctorates							
b. _1__ Other Professionals.....	0.17			960			
c. ____ Paraprofessionals.....							
d. ____ Graduate Students.....							
e. ____ Prebaccalaureate Students.....							
f. ____ Secretarial-Clerical.....							
g. ____ Technical, Shop and Other.....							
Total Salaries and Wages ..... →				3020			
B. Fringe Benefits (If charged as Direct Costs)							
C. Total Salaries, Wages, and Fringe Benefits (A plus B) →				3020			
D. Nonexpendable Equipment (Attach supporting data. List items and dollar amounts for each item.)							
E. Materials and Supplies							
F. Travel							
G. Publication Costs/Page Charges							
H. Computer (ADPE) Costs							
I. Student Assistance/Support (Scholarships/fellowships, stipends/tuition, cost of education, etc. Attach list of items and dollar amounts for each item.)							
J. All Other Direct Costs (In budget narrative, list items and dollar amounts, and provide supporting data for each item.)				1750			
K. Total Direct Costs (C through J)..... →				4770			
L. F&A/Indirect Costs (If applicable, specify rate(s) and base(s) for on/off campus activity. Where both are involved, identify itemized costs included in on/off campus bases.)							
M. Total Direct and F&A/Indirect Costs (K plus L) →				4770			
N. Other..... →							
O. Total Amount of This Request..... →				4770			
P. Carryover -- (If Applicable)Federal Funds: $	**Non-Federal funds: $**		**Total $**				
Q. Cost-Sharing/Matching (Breakdown of total amounts shown on line O) **Cash (both Applicant and Third Party) →**							
- Non Cash Contributions (both Applicant and Third Party)							
NAME AND TITLE (Type or print)				**SIGNATURE** (required for revised budget only)			**DATE**
Project Director: Stephen Tettelbach, Shellfish Ecologist							
Authorized Organizational Representative							

BUDGET JUSTIFICATION – CCE Sub-Award

Budget summary:

Personnel Salaries:			$ 3,020
S. Tettelbach (40 hrs)		$ 2,060	
S. Hughes	(40 hrs)	960	
Boat Use (@$350/day x 5):			$ 1,750
		TOTAL:	$ 4,770

Budget Justification:

Funding is requested for part-time support of two Cornell Cooperative Extension (CCE) staff (each for 40 hrs = 5 days x 8 hrs/day): Dr. Stephen Tettelbach, who will serve as coordinator of extension and field activities (education and outreach activities, scallop sampling, environmental monitoring) and Scott Hughes. Both will participate fully in all fieldwork. The funding request for boat time ($350 days x 5 days) is calculated at standard CCE rates.

A. Salaries and Wages
A.1.a. Co-Principal Investigator and Other Professionals: Salaries are based on current rates for Co-PI Tettelbach (Shellfish Ecologist) and Hughes (Program Educator I) at Cornell Cooperative Extension (CCE) and will remain unchanged throughout the duration of the project. Tettelbach and Hughes will participate fully in the deployment and sampling of scallops placed in the field; Tettelbach will serve as coordinator of these activities.

B. Fringe Benefits: Fringe benefits are not being requested for this project.

E. Expendable Supplies and Equipment: Our research group currently has all major equipment needed to perform the proposed experiments.

F. Travel: No travel funds are requested.

J. All Other Direct Costs: The funding request for boat time ($350 days x 5 days) is calculated at standard CCE rates.

L. Indirect costs: IDC are not allowed by the funding agency.

OMB Approved 0524-0039

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture
CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by NIFA.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first) **Emmanuelle Pales Espinosa**	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL $ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
	Active:				
Allam B, **Pales Espinosa E,** Tettelbach, S	NSF	$199,996	2020-2021	8%	RAPID: A matter of life or death: Identifying factors that regulate susceptibility or resistance of bay scallops to an emergent coccidian parasite
Pales Espinosa E & Allam B	NSF	$520,000	2017-2021	25%	Molecular mechanisms regulating food choice in bivalves
Allam B & **Pales Espinosa E**	New York State	$2,142,597	2017-2022	25%	Understanding and mitigating infectious diseases and environmental challenges facing marine resources in New York State
Allam B, Cerrato R, **Pales Espinosa E**, Lwiza K, O'Dwyer J	NY Sea Grant	$199,978	2019-2021	4%	Effect of current and projected climate conditions on the Atlantic Surfclam Spisula solidissima
Mouget JL, Cognie B and others (Allam B & **Pales Espinosa E** are partners)	European Commission/H2020	1,602,000 Euros (Stony Brook budget: $60,000)	2017-2021	2%	GHaNa: The Genus Haslea, New marine resources for blue biotechnology and Aquaculture
Guo X, Allen S, Proestou D, and others (Allam B & **Pales Espinosa E** are co-PIs for SBU)	Atlantic Marine States Fisheries Commission	Stony Brook Budget = $289,198	2019-2024	2%	From sequence to consequence: genomic selection to expand and improve selective breeding for the eastern oyster
Allam B, **Pales Espinosa E** and others	NY Sea Grant	$239,980	2020-2022	4%	Identification of superior diploid and triploid oyster lines for aquaculture operations in New York
Allam B**, Pales Espinosa E**, Guo X, Reece K, and others	NOAA	$1,200,000	2019-2022	8%	East Coast Hard Clam Selective Breeding Collaborative
Allam B, **Pales Espinosa E** and others	NRAC	$199,990		4%	Comparing the performance of diploid and triploid eastern oysters in the Northeast

Espinosa E, Allam B, Tettelbach S, Rivara K, Green-Beach E **(This proposal)**	**Pending:** NRAC	$69,965	2021-2023	4%	Development of resistant bay scallop strains for aquaculture in the Northeast

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

OMB Approved 0524-0039

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture
CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by NIFA.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first) Bassem Allam	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL $ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
	Active:				
Allam B & Pales Espinosa E	New York State	$2,142,597	2017-2022	1 month	Understanding and mitigating infectious diseases and environmental challenges facing marine resources in New York State
Allam B, Pales Espinosa E, Tettelbach, S	NSF	$199,996	2020-2021	0.5 month	RAPID: A matter of life or death: Identifying factors that regulate susceptibility or resistance of bay scallops to an emergent coccidian parasite
Allam B, Pales Espinosa E, Guo X, Reece K, and others	NOAA	$1,200,000	2019-2022	0.5 month	East Coast Hard Clam Selective Breeding Collaborative
Pales Espinosa E & **Allam B**	NSF	$520,000	2017-2021	0.5 month	Molecular mechanisms regulating food choice in bivalves
Allam B, Cerrato R, Pales Espinosa E, Lwiza K, O'Dwyer J	NY Sea Grant	$199,978	2019-2021	0.5 month	Effect of current and projected climate conditions on the Atlantic Surfclam Spisula solidissima
Mouget JL, Cognie B and others (**Allam B** & Pales Espinosa E are partners)	European Commission/H2020	1,602,000 Euros (Stony Brook budget: $60,000)	2017-2021	0.25 month	GHaNa: The Genus Haslea, New marine resources for blue biotechnology and Aquaculture
Guo X, Allen S, Proestou D, and others **(Allam B** is lead of the SBU sub-award)	Atlantic Marine States Fisheries Commission	Stony Brook Budget = $289,198	2019-2024	0.25 month	From sequence to consequence: genomic selection to expand and improve selective breeding for the eastern oyster
Allam B, Pales Espinosa E and others	NY Sea Grant	$239,980	2020-2022	0.5 month	Identification of superior diploid and triploid oyster lines for aquaculture operations in New York
Allam B, Pales Espinosa E and others	NRAC	$199,990	2020-2022	0.25 month	Comparing the performance of diploid and triploid eastern oysters in the Northeast

Espinosa E, **Allam B,** Tettelbach S, Rivara K, Green-Beach E **(This proposal)**	**Pending:** NRAC	$69,965	2021-2023	0	Development of resistant bay scallop strains for aquaculture in the Northeast

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE

OMB Approved 0524-0039

National Institute of Food and Agriculture

CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by NIFA.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first) Stephen Tettelbach	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL $ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
Smith CF, Tettelbach, ST	Active: Suffolk County Water Quality Protection and Restoration Program/ Contract # HSN1	$283,414	1 Jan – 31 Dec 2020	50	Restoration of Peconic Bay Scallop Populations and Fisheries
Allam B, Pales-Espinosa E	Active: Active: National Science Foundation/ NSF Proposal # 2026358	$199,196	1 May 2020 – 30 April 2021	8	RAPID: A matter of life or death: Identifying factors that regulate susceptibility or resistance of bay scallops to an emergent coccidian parasite
Smith CF, Tettelbach, ST	Pending: Suffolk County Water Quality Protection and Restoration Program	$283,414	1 Jan – 31 Dec 2021	50	Restoration of Peconic Bay Scallop Populations and Fisheries
Kimberly Barbour	Pending: Town of Southampton Community Preservation Fund (CPF) Water Quality Improvement Program	$579,328	1 Nov 2020 – 31 Dec 2022	25	Shellfish and Habitat Restoration in Support of Water Quality Improvement
Pales-Espinosa E, Allam B	Northeast Regional Aquaculture Center	$60,000	1 Dec 2021 – 30 Nov 2023	3	Development of resistant bay scallop strains for aquaculture in the Northeast

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average 1.00 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

OMB Approved 0524-0039

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture
CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by NIFA.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first) Karen Rivara	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL $ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
Karen Rivara	Nothing to report				

OMB Approved 0524-0039

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture
CURRENT AND PENDING SUPPORT

Instructions:

1. Record information for active and pending projects, including this proposal. (Concurrent submission of a proposal to other organizations will not prejudice its review by NIFA.)
2. All current efforts to which project director(s) and other senior personnel have committed a portion of their time must be listed, whether or not salary for the person involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed work which is being considered by, or which will be submitted in the near future to, other possible sponsors including other USDA programs.

NAME (List/PD #1 first) Emma Green-Beach	SUPPORTING AGENCY AND AGENCY ACTIVE AWARD/PENDING PROPOSAL NUMBER	TOTAL $ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
Green-Beach E	Active: Edey Foundation	$9,000	March 2020-Dec 2021	5%	Investigating the tolerance of Edgartown Great Pond and Tisbury Great Pond native oysters to the parasite *Perkinsus marinus*

The Research Foundation for
The State University of New York

Stony Brook University

Office of Sponsored Programs
W5510 Frank Melville Jr. Library
State University of New York
Stony Brook, New York 11794-3362

Telephone: 631-632-4402/9949
Fax: 631-632-6963

www.stonybrook.edu/research

October 15, 2020

Dr. Reginal Harrell, Director
Northeastern Regional Aquaculture Center
University of Maryland
2113 Animal Sciences Bldg. 142
College Park, MD 20742-2317

SUBJECT: Development of resistant bay scallop strains for aquaculture in the Northeast

Dear Dr. Harrell:

As the Authorized Organizational Representative (AOR) I would like to inform you that the Research Foundation for the State University of New York wishes to participate in the above referenced project as a subcontractor to the University of Maryland. Dr. Emmanuelle Pales Espinosa will serve as the Principal Investigator of the subcontract and will have access to all of the necessary equipment, laboratory, and office space to successfully undertake this project. I also approve the budget as submitted for Dr. Pales Espinosa's involvement in this project. Upon issuance of approval to the Northeastern Regional Aquaculture Center for this project, the Research Foundation for SUNY will enter into a formal agreement with your institution.

Sincerely,

Sabrina Cerezo
Assistant Director for Grants
Office of Sponsored Programs

October 12, 2020

Dr. Emmanuelle Pales Espinosa, Research Associate Professor
School of Marine and Atmospheric Sciences
Stony Brook, NY 11794-5000

SUBJECT: Development of resistant bay scallop strains for aquaculture in the Northeast

Dear Dr. Pales Espinosa:

As the Authorized Organizational Representative (AOR) I would like to inform you that Cornell Cooperative Extension of Suffolk County wishes to participate in the above referenced project as a subcontractor to Stony Brook University. Dr. Stephen Tettelbach will serve as the Principal Investigator of the subcontract and he have access to all of the necessary equipment, laboratory, and office space to successfully undertake this project. I also approve the budget as submitted for Tettelbach's involvement in this project. Upon issuance of approval to the Northeastern Regional Aquaculture Center for this project, Cornell Cooperative Extension will enter into a formal agreement with your institution.

Sincerely,

Vanessa Lockel

Vanessa Lockel
Executive Director

Cornell Cooperative Extension is an employer and educator recognized for valuing AA/EEO, Protected Veterans, and Individuals with Disabilities and provides equal program and employment opportunities.

Stony Brook University
School *of* Marine and
Atmospheric Sciences

Stony Brook University, Stony Brook, NY 11794-5000
Tel: 631-632-8694; Fax: 631-632-8915
Email: Emmanuelle.PalesEspinosa@stonybrook.edu

Emmanuelle Pales Espinosa
Research Associate Professor

October 13, 2020

Dr. Reginal Harrell, Director
Northeastern Regional Aquaculture Center
University of Maryland
2113 Animal Sciences Bldg. 142
College Park, MD 20742-2317

Subject: Project entitled "Development of resistant bay scallop strains for aquaculture in the Northeast"

Dear Dr. Harrell,

Please accept this letter as confirmation for my participation as a lead PI (Project Director) for the subject proposal, which is being submitted in response to the Northeast Regional Aquaculture Center's 2021 Request for Full Proposals. Members of the assembled research team have a unique set of complementary skills that support the success of the proposed activities. I have led and contributed to several large and successful projects in the past, including projects with some members of the current team, and hence I am confident about our ability to attain the proposed objectives. We genuinely believe that the results of the proposed studies will set the stage for the development of a regional selective breeding program for the bay scallop. We are excited about the opportunity of undertaking these investigations. While looking forward to hearing your decision on this request, please let me know if you need further information.

Yours sincerely,

Dr. Emmanuelle Pales Espinosa
Research Associate Professor

Stony Brook University
School *of* Marine and
Atmospheric Sciences

Stony Brook University, Stony Brook, NY 11794-5000
Tel: 631-632-8745; Fax: 631-632-8915
Email: Bassem.Allam@stonybrook.edu

Bassem Allam
Professor

October 13, 2020

Dr. Reginal Harrell, Director
Northeastern Regional Aquaculture Center
University of Maryland
2113 Animal Sciences Bldg. 142
College Park, MD 20742-2317

Subject: Project entitled "Development of resistant bay scallop strains for aquaculture in the Northeast"

Dear Dr. Harrell,

This letter is to confirm that I am willing to participate as a co-PI on the proposed project: "*Development of resistant bay scallop strains for aquaculture in the Northeast*", which is being submitted by Dr. Emmanuelle Pales Espinosa in response to the Northeast Regional Aquaculture Center's 2021 Request for Full Proposals. Although I am not asking for any salary support from the grant, I will contribute to the various aspects of the work as described in the proposal, with a particular focus on pathological investigations of the experimental scallops derived from field and lab investigations. Further, through my endowed professorship, I have access to discretionary funds that can be used as needed to complement the resources provided by NRAC to perform the activities described in this seed application. I truly believe that the research proposed here has the potential for transforming bay scallop breeding to allow a better adaptation to our changing environment and disease landscape.

Warmest regards,

Bassem Allam, Marinetics Endowed Professor
Marine Animal Disease Laboratory
http://you.stonybrook.edu/madl

Cornell Cooperative Extension
Suffolk County

Marine Program
Suffolk County Environmental Learning Center
3690 Cedar Beach Road
Southold, NY 11971
Phone: (631) 852-8660
Fax: (631) 852-8662
http://ccesuffolk.org/marine

October 5, 2020

Drs. Emmanuelle Pales-Espinosa and Bassem Allam
Dana Hall 149
School of Marine and Atmospheric Sciences
Stony Brook University, Stony Brook, NY 11794-5000

Dear Emmanuelle and Bassem:

Please accept this letter as formal indication of my willingness to work with you and the rest of your team on the submitted NRAC project proposal: "Development of resistant bay scallop strains for aquaculture in the Northeast". I am excited about this project as I think it offers real hope to address the scallop die-offs which have occurred in the Peconic Bays in each of the last two years.

If funding is secured, I will work with Scott Hughes at CCE to deploy cultured scallops at field sites in the Peconic Bays as well as conduct sampling during the course of the project. My contributions will also include steering extension activities associated with the project. We look forward to working with you on this exiting research!

Sincerely,

Stephen Tettelbach,
Shellfish Ecologist

Cornell Cooperative Extension is an employer and educator recognized for valuing AA/EEO, Protected Veterans, and Individuals with Disabilities and provides equal program and employment opportunities.

aeros
cultured oyster company

October 12, 2020

Dr. Emmanuelle Pales Espinosa
Research Associate Professor
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000

Dear Dr. Pales Espinosa,

I am writing to confirm the participation of Aeros Cultured Oyster Company, Inc. in the NRAC proposal, "Development of resistant bay scallop strains for aquaculture in the Northeast". Aeros would spawn and cultivate separate strains of bay scallops in their hatchery and nursery facilities in Southold, New York for this project.

Developing disease resistant bay scallops is important for the maintenance of a vital bay scallop industry on the East End of Long Island. The Peconic Bay Scallop fishery has been an important source of winter income for commercial baymen for decades. It is our hope that working on this project we can make a contribution to the economy of our region by insuring the future of this industry and by supporting the growth of the scallop aquaculture in the Northeast.

We look forward to working with you on this project.

Sincerely,

Karen Rivara

Aeros Cultured Oyster Co

Aeros Cultured Oyster Company, Inc. • P.O. Box # 964 • Southold, New York 11971
Phone/Fax: (631) 765-1808

MARTHA'S VINEYARD
SHELLFISH GROUP
1976

October 2020

Dr. Emmanuelle Pales Espinosa
Research Associate Professor
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000

Dear Dr. Pales Espinosa,

I am writing to express the commitment of the Martha's Vineyard Shellfish Group, Inc. (MVSG) to the NRAC funded project, "Development of resistant bay scallop strains for aquaculture in the Northeast". MVSG will manage the grow-out and sampling of experimental bay scallops at the Massachusetts field site, on Martha's Vineyard.

We are fully supportive of this project because bay scallops are a vital part of the economy of Martha's Vineyard. Currently, the wild fishery injects roughly $5 million dollars, on average, into the winter economy of a heavily summer tourism-focused community. As the wild fishery continues to struggle and decline, shellfish farmers are preparing to diversity into bay scallop aquaculture. We have not yet experienced the severe mortalities as have occurred in New York, and so we are well poised to serve as a control site. We hope to be part of this proactive research so that the aquaculture industry may benefit from the results. The mission of MVSG is *to restore shellfish resources for the wellbeing of the entire Island community*, and this research will prove to be an important tool to this end.

We look forward to working on this project with you and your team.

Sincerely,

Emma Green-Beach
Executive Director and Shellfish Biologist

P.O. Box 1552 ~ Oak Bluffs, MA 02557
emma.greenbeach@mvshellfishgroup.org

Martha's Vineyard Shellfish Group, Inc.
Box 1552
Oak Bluffs, Massachusetts 02557
508 693-0391

October 11, 2020

Dr. Bassem Allam
Dana Hall 149
School of Marine and Atmospheric Sciences
Stony Brook University, Stony Brook, NY 11794-5000

RE: Participation in the project *"Development of resistant bay scallop strains for aquaculture in the Northeast"*

Dear Bassem,

I am writing to confirm my intent to be an industry participant in the proposed NRAC project titled: *"Development of resistant bay scallop strains for aquaculture in the Northeast"*

I agree to assist Emma Green-Beach in the field grow-out trials of scallops to be carried out on Martha's Vineyard. I agree to be available in a consulting capacity to provide my expertise and assist as needed in handling the scallops prior to deployment, during the field trial grow-out and final sampling.

I look forward to participating in this exciting project that promises to benefit both public and private bay scallop aquaculture efforts in the region. Good luck with the proposal.

Thank you.

Sincerely,

Richard C. Karney
Shellfish Biologist & Director Emeritus

Montowese Bay Scallops
D. J. King II
275 Linden Ave
Branford CT 06405

Dr. Emmanuelle Pales Espinosa
Research Associate Professor
School of Marine and Atmospheric Sciences
Stony Brook University
Stony Brook, NY 11794-5000

Dear Dr. Pales Espinosa,

I am writing to affirm my commitment to the proposed research entitled: "Development of resistant bay scallop strains for aquaculture in the Northeast".
The use of selected bivalve lines in aquaculture has increased significantly in recent years, particularly in the Northeast, which was markedly hit by disease outbreaks and changing climate conditions. My farm grows bay scallops and I am therefore very concerned about the recent reports of large scale mortality events that occurred in NY. Therefore, your effort to evaluate selective breeding as a means to mitigate disease and temperature stress is very timely.
If this proposal is successful, I commit to providing space on my farm for the grow-out of the 5 scallop lines during the field-testing phase of the project. My staff will also provide researchers with access to the crop for monitoring and assist with monitoring, as necessary.

Sincerely,

Donald J. King II

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

CONFLICT OF INTEREST LIST
FOR COMPETITIVE PROGRAMS ONLY

Name: **Emmanuelle Pales Espinosa**

For each project director (PD) and other personnel that are required based on the specific program guidelines, list alphabetically by last name (and with last name first), the full names of individuals in the following categories and mark each category which applies with an □x□. Additional pages may be used as necessary. A conflict of interest list for each PD must be submitted before a proposal is considered complete. Inclusion of a C.V. or publication list in the proposal is not sufficient.

- All co-authors on publications within the past four years, including pending publications and submissions
- All collaborators on projects within the past four years, including current and planned collaborations
- All thesis or postdoctoral *advisees/advisors*
- All persons in your field with whom you have had a consulting/financial arrangement/other conflict-of-interest in the past four years

Note: Other individuals working in the applicant's specific area are not in conflict of interest with the applicant unless those individuals fall within one of the listed categories.

Name	Co-Author	Collaborator	Advisees/ Advisors	Other – Specify Nature
Barnes, Debra		x		
Boutet, Isabelle		x		
Carden, Wade	x	x		
Cerrato, Robert	x	x		
Cognie, Bruno		x		
Collier, Jackie	x	x		
Corre, Erwan	x	x		
Dahl, Soren	x	x		
del Castillo, Carmelo	x			
Gobler, Christopher		x		
Guo, Ximing		x		
Jing, Xing	x	x		
Katalay, Selma	x	x		
Koller, Antonius	x	x		
Lallier, Francois	x	x		
Lau, Yuk-Ting	x		x	
Le Panze, Sophie	x	x		
McElroy, Anne		x		
Paillard, Christine	x	x		
Perrigault, Mickael	x		x	
Robert, Jean Michel			x	
Rosa, Maria	x	x		
Rubin, Ewelina	x		x	
Shumway, Sandra	x	x		
Smolowitz, Roxanna	x	x		

Tanguy, Arnaud	x	x		
Tettelbach, Stephen		x		
Thanassi, David	x	x		
Vasta, Gerardo		x		
Wang, Kailai	x		x	
Ward, Evan	x	x		
Werneburg, Glen	x			
Wikfors, Gary	x	x		
Winnicki, Sarah	x	x		

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average .5 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.Form CSREES 2007

UNITED STATES DEPARTMENT OF AGRICULTURE
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

OMB Approved 0524-0039
Expires 03/31/2004

CONFLICT OF INTEREST LIST
FOR COMPETITIVE PROGRAMS ONLY

Name: **Bassem Allam**

For each project director (PD) and other personnel that are required based on the specific program guidelines, list alphabetically by last name (and with last name first), the full names of individuals in the following categories and mark each category which applies with an □x□. Additional pages may be used as necessary. A conflict of interest list for each PD must be submitted before a proposal is considered complete. Inclusion of a C.V. or publication list in the proposal is not sufficient.

- All co-authors on publications within the past four years, including pending publications and submissions
- All collaborators on projects within the past four years, including current and planned collaborations
- All thesis or postdoctoral *advisees/advisors*
- All persons in your field with whom you have had a consulting/financial arrangement/other conflict-of-interest in the past four years

Note: Other individuals working in the applicant's specific area are not in conflict of interest with the applicant unless those individuals fall within one of the listed categories.

Name	Co-Author	Collaborator	Advisees/ Advisors	Other – Specify Nature
Barnes, Debra		x		
Bettencourt, Raul	x		x	
Boutet, Isabelle	x	x		
Bowser, Paul		x		
Cerrato, Robert	x	x		
Collier, Jackie	x	x		
Corre, Erwan	x	x		
Dahl, Soren	x		x	
del Castillo, Carmelo	x		x	
Doall, Mickael	x	x		
Dove, Alistair	x	x		
Fast, Mark	x	x		
Gobler, Christopher		x		
Guo, Ximing	x	x		
Jing, Xing	x		x	
Katalay, Selma	x		x	
Koller, Antonius	x	x		
Lallier, Francois	x	x		
Lau, Yuk-Ting (Joyce)	x		x	
Le Panze, Sophie	x	x		
Le Pennec, Marcel			x	
Levinton, Jeffrey	x	x		
Liu, Qianqian	x		x	
Mars-Brisbin, Margareth	x		x	
McElroy, Anne	x	x		

Paillard, Christine	x	x		
Perrigault, Mickael	x		x	
Raftos, David	x			
Ralston, David		x		
Rosa, Maria	x	x		
Rubin, Ewelina	x		x	
Serrao Santos, Ricardo	x			
Shumway, Sandra	x	x		
Smolowitz, Roxanna	x	x		
Tanguy, Arnaud	x	x		
Taylor, Gordon	x	x		
Tettelbach, Stephen		x		
Thanassi, David	x	x		
Vasta, Gerardo		x		
Wang, Kailai	x		x	
Ward, Evan	x	x		
Werneburg, Glen	x			
Wikfors, Gary	x	x		
Winnicki, Sarah	x		x	

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average .5 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture

OMB Approved 0524-0039

CONFLICT OF INTEREST LIST
FOR COMPETITIVE PROGRAMS ONLY

Name: Stephen Tettelbach

For each project director (PD) and other personnel that are required based on the specific program guidelines, list alphabetically by last name (and with last name first), the full names of individuals in the following categories and mark each category which applies with an □x□. Additional pages may be used as necessary. A conflict of interest list for each PD must be submitted before a proposal is considered complete. Inclusion of a C.V. or publication list in the proposal is not sufficient.

- All co-authors on publications within the past four years, including pending publications and submissions
- All collaborators on projects within the past four years, including current and planned collaborations
- All thesis or postdoctoral *advisees/advisors*
- All persons in your field with whom you have had a consulting/financial arrangement/other conflict-of-interest in the past four years

Note: Other individuals working in the applicant's specific area are not in conflict of interest with the applicant unless those individuals fall within one of the listed categories.

Name	Co-Author	Collaborator	Advisees/ Advisors	Other – Specify Nature
Bradley T. Furman	X	X		
Scott W.T. Hughes	X	X		
John M. Carroll	X	X		
Bradley J. Peterson	X	X		
Jason Havelin	X	X		
Christian R.H. Tettelbach	X	X		
R. Michael Patricio	X	X		
Jason S. Grear	X			
Cecilia A. O'Leary	X			
Janet A. Nye	X			
Christopher J. Gobler	X			
James R. Europe	X		X	
Brooke S. Rodgers	X			
Marissa Velasquez	X	X	X	
Bassem Allam	X	X		
Emmanuelle Pales-Espinosa	X	X		
Karen Rivara		X		
Madison Muehl	X	X		
Richard Karney		X		
Emma Green-Beach		X		
Kim Tetrault		X		
Gregg J. Rivara		X		
Christopher F. Smith	X	X		
Matthew Sclafani	X	X		
Justin Bopp	X	X		
Kayla M. Mladinich	X	X	X	
Chelsea T. Miller	X	X	X	
Barry Udelson	X	X	X	

Robin Lynn	X	X	X	
Hailey M. Brosnan	X	X	X	
Jonathan Mashal	X	X	X	
Matthew Schwartz	X	X	X	
Brigid A. Maloney	X	X	X	
Tracey Vlasak	X	X	X	
Lisa L. Jackson	X			
Rebecca E. Kulp	X			
Elizabeth Gomez	X			
Nils Volkenborn	X	X		
Stephen Tomasetti	X	X		
Frank Sloup		X		
Peter Wenzel		X		

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0524-0039. The time required to complete this information collection is estimated to average .5 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture

OMB Approved 0524-0039

CONFLICT OF INTEREST LIST
FOR COMPETITIVE PROGRAMS ONLY

Name: Karen Rivara

For each project director (PD) and other personnel that are required based on the specific program guidelines, list alphabetically by last name (and with last name first), the full names of individuals in the following categories and mark each category which applies with an □x□. Additional pages may be used as necessary. A conflict of interest list for each PD must be submitted before a proposal is considered complete. Inclusion of a C.V. or publication list in the proposal is not sufficient.

- All co-authors on publications within the past four years, including pending publications and submissions
- All collaborators on projects within the past four years, including current and planned collaborations
- All thesis or postdoctoral *advisees/advisors*
- All persons in your field with whom you have had a consulting/financial arrangement/other conflict-of-interest in the past four years

Note: Other individuals working in the applicant's specific area are not in conflict of interest with the applicant unless those individuals fall within one of the listed categories.

Name	Co-Author	Collaborator	Advisees/ Advisors	Other – Specify Nature
No conflicts to report				

UNITED STATES DEPARTMENT OF AGRICULTURE
National Institute of Food and Agriculture

OMB Approved 0524-0039

CONFLICT OF INTEREST LIST
FOR COMPETITIVE PROGRAMS ONLY

Name: Emma Green-Beach

For each project director (PD) and other personnel that are required based on the specific program guidelines, list alphabetically by last name (and with last name first), the full names of individuals in the following categories and mark each category which applies with an □x□. Additional pages may be used as necessary. A conflict of interest list for each PD must be submitted before a proposal is considered complete. Inclusion of a C.V. or publication list in the proposal is not sufficient.

- All co-authors on publications within the past four years, including pending publications and submissions
- All collaborators on projects within the past four years, including current and planned collaborations
- All thesis or postdoctoral *advisees/advisors*
- All persons in your field with whom you have had a consulting/financial arrangement/other conflict-of-interest in the past four years

Note: Other individuals working in the applicant's specific area are not in conflict of interest with the applicant unless those individuals fall within one of the listed categories.

Name	Co-Author	Collaborator	Advisees/ Advisors	Other – Specify Nature
Karney, Richard		x		
Vaudrey, Jamie		x		
Edmundson, Shelley		x		
Wikfors, Gary		x		
Rheault, Bob		x		
Shumway, Sandra		x		
Morton, Steve		x		
Walton, Bill		x		
Beal, Brian		x		
Davis, Joth		x		

Emmanuelle M. PALES ESPINOSA
Research Associate Professor, School of Marine and Atmospheric Sciences (SoMAS)
Stony Brook University, Stony Brook NY 11794-5000
Phone: (631) 632-8694, Email: Emmanuelle.Palesespinosa@Stonybrook.edu,
https://you.stonybrook.edu/emmanuellepalesespinosa/

Professional Preparation

Rutgers University, NJ (USA)	Bivalve Ecophysiology	Post-doc, 1999
University of Nantes (France)	Microalgae Ecology	Ph.D., 1999
University of Paris VI (UPMC, France)	Algology	Post-Graduate research degree, 1993
University of Western Brittany (France) & Birmingham University (England)	Algology	Erasmus summer course, 1992
University of Western Brittany (France)	Oceanography	M.S., 1992
University of Western Brittany (France)	Biology / Chemistry	B.S., 1991

Professional Experience:

Research Associate Professor, Stony Brook University, Stony Brook, NY	2016-present
Adjunct Assistant Professor, Stony Brook University, Stony Brook, NY	2008-2016
Research Scientist, Stony Brook University, Stony Brook, NY	2007-2016
Adjunct lecturer, Stony Brook University, Southampton, NY	2007-2008
Assistant in Fishery Management, NYS Department of Environmental Conservation, NY	2006-2008
Research Scientist, Stony Brook University, Stony Brook, NY	2004-2005
Environmental Coordinator, Armor S.A., Nantes, France	2001-2003
Research Scientist, Marine Biology Laboratory, University of Nantes, France	2000
Research and Teaching Associate, University of Nantes, France	1994-1999

Synergistic Activities

Serve as a member of the NYS Shellfish Restoration Council (Governor Cuomo initiative to support and guide shellfish restoration)

Serve as a panelist and reviewers for multiple journals/agencies

Developed an outreach program at the Long Island Aquarium, NY (2016-present)

Created a series of videos on bivalves (2017-present)

Guest lecturer at local schools (Port Jefferson and East Setauket Elementary Schools, Longwood Junior High School, NY) presenting slide shows about marine biology, guiding hands-on sessions on marine animals and discussing careers in marine biology.

Participate yearly in the coordination of the "Scallop Bowl", a regional competition for the National Ocean Sciences Bowl.

Developed curricular materials in Oceanography (Stony Brook University) and Marine Biology (University of Nantes).

Most Relevant Publications

Farhat S, Tanguy A, **Pales Espinosa E**, Guo X, Boutet I, Smolowitz R, Murphy D, Rivara G, Allam B. 2020. Identification of variants associated with hard clam, *Mercenaria mercenaria*, resistance to Quahog Parasite Unknown disease. Genomics 112(6): 4887-4896

Hornstein J, **Pales Espinosa E**, Cerrato R, Lwiza K, Allam B. 2018. The influence of temperature stress on the physiology of the Atlantic surfclam, *Spisula solidissima*. Comparative Biochemistry and Physiology Part A 222: 66-73.

Wang K, **Pales Espinosa E**, Tanguy A, Allam B. 2016. Alterations of the immune transcriptome in resistant and susceptible hard clams (*Mercenaria mercenaria*) in response to Quahog Parasite Unknown (QPX) and temperature. Fish and Shellfish Immunology 49: 163-176.

Pales Espinosa E, Allam B. 2018. Reverse genetics demonstrate the role of mucosal C-type lectins in food particle selection in the oyster *Crassostrea virginica*. *Journal of Experimental Biology*, 221: jeb174094.

Fernández Robledo JA, Yadavalli R, Allam B, **Pales Espinosa E**, Gerdol M, Greco S, Stevick RJ, Gómez-Chiarri M, Zhang Y, Heil CA, Tracy AN, Bishop-Bailey D, Metzger MJ. 2019. From the raw bar to the bench: Bivalves as models for human health. *Developmental and Comparative Immunology*, 92: 260-282.

Other Recent Publications

Pales Espinosa E, Allam B. 2021. High spatial resolution mapping of the mucosal proteome of the gills of *Crassostrea virginica*: implication in particle processing. *Journal of Experimental Biology*. In Press.

Allam S, Allam B, **Pales Espinosa E**. 2021. Regulation of mucosal lectins in the oyster *Crassostrea virginica* in response to food availability and environmental factors. *Journal of Molluscan Studies*. In Press.

Cerullo A, Ying T.L, Allam B, Baer A, Barnes WJP, Barrientos Z, Deheyn DD, Fudge DS, Gould J, Harrington MJ, Holford M, Hung CS, Jain G, Mayer G, Medina M, Monge-Nájera J, Napolitano T, **Pales Espinosa E**, Schmidt S, Thompson EM, Braunschweig AB. 2020. Comparative animal mucomics: Inspiration for functional materials from ubiquitous and understudied biopolymers. 2020. *ACS Biomaterials Science and Engineering*. In Press. DOI: 10.1021/acsbiomaterials.0c00713

Jones J, Allam B, **Pales Espinosa E**. 2020. Particle selection in suspension-feeding bivalves: does one model fit all? *Biological Bulletin*, 238(1): 41-53.

Schwaner C, Barbosa M, Connors P, Park TJ, de Silva D, Griffith A, Gobler C, **Pales Espinosa E**, Allam B. 2020. Experimental acidification increases susceptibility of *Mercenaria mercenaria* to infection by *Vibrio* species. *Marine Environmental Research*, 154, 104872.

Barbosa M, Schwaner C, Schwemmer T, **Pales Espinosa E**, Allam B. 2019. Effect of food resource availability on resilience of eastern oyster larvae to ocean acidification. World Aquaculture, 50(3): 27-29.

Lau Y-T, Santos B, Barbosa M, **Pales Espinosa E**, Allam B. 2018. Regulation of apoptosis-related genes during interactions between oyster hemocytes and the alveolate parasite *Perkinsus marinus*. *Fish and Shellfish Immunology* 83: 180-189

Lau Y-T, Sussman L, **Pales Espinosa E**, Katalay S, Allam B. 2017. Characterization of hemocytes from different body fluids of the eastern oyster *Crassostrea virginica*. *Fish and Shellfish Immunology,* 71: 372-379.

Rubin E, Tanguy A, **Pales Espinosa E**, Allam B. 2017. Differential gene expression in five isolates of the clam pathogen, quahog parasite unknown (QPX). *Journal of Eukaryotic Microbiology*, 64: 647-654.

Wang K, **Pales Espinosa E**, Tanguy A, Allam B. 2016. Alterations of the immune transcriptome in resistant and susceptible hard clams (*Mercenaria mercenaria*) in response to Quahog Parasite Unknown (QPX) and temperature. *Fish and Shellfish immunology*, 49: 163-76.

Pales Espinosa E, Koller A, Allam B. 2016. Proteomic characterization of mucosal secretions in the eastern oyster, *Crassostrea virginica*. *Journal of Proteomics*, 132: 63-76

Wang K, Del Castillo C, Corre E, **Pales Espinosa E**, Allam B. 2016. Clam focal and systemic immune responses to QPX by RNA-Seq technology. *BMC Genomics*, 17: 1-9.

Allam B, **Pales Espinosa E.** 2016. Bivalve immunity and response to infections: Are we looking at the right place? *Fish and Shellfish Immunology*, 53: 4-12. (Invited review paper)

Bassem Allam
Marinetics Endowed Professor, School of Marine and Atmospheric Sciences (SoMAS)
Stony Brook University, Stony Brook, NY 11794-5000
Phone: (631) 632-8745, Fax: (631) 632-8915,
Email: Bassem.Allam@stonybrook.edu ; http://you.stonybrook.edu/madl/

Professional preparation:

Lebanese University (Lebanon)	Natural Sciences/Biology	M.S., 1990
University of Western Brittany (France)	Biological Oceanography	M.S., 1993
University of Western Brittany (France)	Biological Oceanography	Ph.D., 1998
Rutgers University, IMCS, NJ	Molluscan Pathobiology	Post-doc, 1998-99
Marine Biological Laboratory, MA	Aquavet 2 (intensive course)	120 hrs course (2003)
Cold Spring Harbor Laboratory	Adv. Sequencing Technol. & Applications	120 hrs course (2013)

Professional Experience:

Professor, SoMAS, Stony Brook University, NY, 2015-present (endowed in 2016)
Associate Professor, SoMAS, Stony Brook University, NY, 2009-2014
Assistant Professor, SoMAS, Stony Brook University, NY, 2003-2009
Courtesy Faculty, College of Veterinary Medicine, Cornell University, Ithaca, NY, 2005- present
Research and Teaching Associate, University of Antilles-Guyana (Guadeloupe), 2000-2001
Research and Teaching Associate, University of Angers (France), 1999-2000:
Post-doctoral Research Associate, Rutgers University, NJ, 1998-1999

Synergistic Activities and Achievements:

Member, editorial boards of the journal *Diseases of Aquatic Organisms* and the *Journal of Invertebrate Pathology*
Adjunct Faculty, Department of Microbiology & Immunology, Cornell University (since 2005)
Guest instructor, University of Padova, Italy (2017) and the Marine Biological Laboratory (2016)
Fellow (Director of Research) of the Centre National de la Recherche Scientifique, Roscoff, France (Fall 2010) and the European Institute for Marine Studies, Brest, France (spring-summer 2011)
Consulting services to the Long Island Association of Shellfish Managers and the New York State's Department of Environmental Conservation (Shellfish Bureau)
Member of the Eastern Oyster Breeding Consortium

Selected Relevant Publications: * *indicate students*

Farhat S, Tanguy A, Pales Espinosa E, Guo X, Boutet I, Smolowitz R, Murphy D, Rivara G, **Allam B.** (2020). Identification of variants associated with hard clam, Mercenaria mercenaria, resistance to Quahog Parasite Unknown disease. Genomics 112(6): 4887-4896

Hornstein J, Pales Espinosa E, Cerrato R, Lwiza K, **Allam B.** (2018). The influence of temperature stress on the physiology of the Atlantic surfclam, Spisula solidissima. Comparative Biochemistry and Physiology Part A 222: 66-73.

Wang K, Pales Espinosa E, Tanguy A, **Allam B.** (2016). Alterations of the immune transcriptome in resistant and susceptible hard clams (Mercenaria mercenaria) in response to Quahog Parasite Unknown (QPX) and temperature. Fish and Shellfish Immunology 49: 163-176.

Dahl S, Perrigault M, Liu Q, Collier JL, Barnes DA, **Allam B.** (2010). Effects of temperature on hard clam (Mercenaria mercenaria) immunity and QPX (Quahog parasite unknown) disease development: I. Dynamics of QPX disease. Journal of Invertebrate Pathology 106: 314-321.

Dahl S, Perrigault M, **Allam B.** (2008). Laboratory transmission studies of QPX disease in the hard clam: Pathogenicity of different pathogen isolates toward various clam stocks. Aquaculture 280:64-70.

Other Recent (since 2017) Publications (of ~100): ** indicate students*

*Cerullo A, *Lai T-Y, **Allam B**, Baer A, Barnes J, Barrientos Z, Deheyn D, Fudge D, Gould J, Harrington M, Holford M, Hung C-S, Jain G, Mayer G, Medina-Munoz M, Monge J, Napolitano T, Pales Espinosa E, Schmidt S, Thompson E, Braunschweig A. (2020). Comparative animal mucomics: Inspiration for functional materials from ubiquitous and understudied biopolymers. ACS Biomaterials Science & Engineering. In Press. DOI: 10.1021/acsbiomaterials.0c00713

*Allam S, **Allam B**, Pales Espinosa E. (2020). Regulation of mucosal lectins in the oyster Crassostrea virginica in response to food availability and environmental factors. Journal of Molluscan Studies. In Press.

*Zuykov M, **Allam B**, Gosselin M, Archambault P, Spiers G, Schindler M. (2020). First report of signs of infection by Coccomyxa-like algae in wild blue mussels, Mytilus spp., in the Gulf of Maine (USA, Maine). Journal of Fish Diseases 43: 775-778.

*Jones J, **Allam B**, Pales Espinosa E. (2020). Particle selection in suspension-feeding bivalves: Does one model fit all? Biological Bulletin 238: 41-53.

*Schwaner C, *Barbosa M, *Connors P, Park TJ, *de Silva D, Griffith A, Gobler CJ, Pales Espinosa E, **Allam B.** (2020). Experimental acidification increases susceptibility of Mercenaria mercenaria to infection by Vibrio species. Marine Environmental Research 154: 104872

Rosani U, Shapiro M, Venier P, **Allam B.** (2019). A needle in a haystack: Tracing bivalve-associated viruses in high-throughput transcriptomic Data. Viruses 11, 205; doi:10.3390/v11030205

*Barbosa M, *Schwaner C, *Schwemmer T, Pales Espinoa E, **Allam B.** (2019). Effect of food resource availability on the resilience of eastern oyster larvae to ocean acidification. World Aquaculture 5(30)

Fernández-Robledo JA, Yadavalli R, **Allam B**, Pales-Espinosa E, Gerdol M, Greco S, Stevick RJ, Gómez-Chiarri M, Zhang Y, Heil CA, Tracy AN, Bishop-Bailey D, Metzger MJ. (2019). From the raw bar to the bench: Bivalves as models for human health. Dev. Comp. Immunol. 92: 260-282.

Pales Espinosa E, **Allam B.** (2018). Reverse genetics demonstrate the role of mucosal C-type lectins in food particle selection in the oyster Crassostrea virginica. Journal of Experimental Biology: jeb.174094 doi: 10.1242/jeb.174094

*Lau Y-T, *Santos B, *Barbosa M, Pales Espinosa E, **Allam B.** (2018). Regulation of apoptosis-related genes during interactions between oyster hemocytes and the alveolate parasite Perkinsus marinus. Fish and Shellfish Immunology 83: 180-189.

*Lau Y-T, *Gambino L, *Santos B, Pales Espinosa E, **Allam B.** (2018). Regulation of oyster (Crassostrea virginica) hemocyte motility by the intracellular parasite Perkinsus marinus: A possible mechanism for host infection. Fish and Shellfish Immunology 78: 18-25.

*Hornstein J, Pales Espinosa E, Cerrato R, Lwiza K, **Allam B.** (2018). The influence of temperature stress on the physiology of the Atlantic surfclam, Spisula solidissima. Comparative Biochemistry and Physiology Part A 222: 66-73.

*Lau Y-T, *Gambino L, *Santos B, Pales Espinosa E, **Allam B.** (2018). Transepithelial migration of mucosal hemocytes in Crassostrea virginica and potential role in Perkinsus marinus pathogenesis. Journal of Invertebrate Pathology 153: 122-129.

Bassim S, **Allam B.** (2018). SNP hot-spots in the clam parasite QPX. BMC Genomics 19: 486.

*Hartman R, Pales Espinosa E, **Allam B.** (2018). Identification of clam plasma proteins that bind its pathogen Quahog Parasite Unknown. Fish and Shellfish Immunology 77: 214-221.

*Liu Q, Collier JL, **Allam B.** (2017). Seasonality of QPX disease in the Raritan Bay (NY) wild hard clam (Mercenaria mercenaria) population. Aquaculture Research 48: 1269-1278.

*Lau Y-T, *Sussman L, Pales Espinosa E, Katalai S, **Allam B.** (2017). Characterization of hemocytes from different body fluids of the eastern oyster Crassostrea virginica. Fish Immun. 71: 372-379.

*Rubin E, Tanguy A, Pales Espinosa E, **Allam B.** (2017). Differential gene expression in five isolates of the clam pathogen, quahog parasite unknown (QPX). J. Eukar. Microbiol. 64: 647-654.

BIOGRAPHICAL SKETCH

Stephen T. Tettelbach
Shellfish Ecologist, Cornell Cooperative Extension, Southold, NY 11971
Phone: (631) 862-8660 //Email: stt47@cornell.edu
http://ccesuffolk.org/marine/aquaculture/scallop-program

Professional Preparation:

University of Miami	Biology	B.S., 1976
University of Washington	Fisheries Biology	M.S., 1979
University of Connecticut	Ecology	Ph.D., 1986

Most Recent Appointments:

Shellfish Ecologist, Cornell Cooperative Extension, Southold, NY, 2019-present
Professor Emeritus of Biology, Long Island University, Brookville, NY, 2019-present
Professor of Biology, Long Island University, Brookville, NY, 2005-2019
Professor of Marine Science & Biology, Long Island University, Southampton, NY, 2002-2005

Recent Pertinent Publications ** and ** indicate graduate and undergraduate students*

Tettelbach ST, Furman BT, Hughes SWT, Carroll JM, Peterson BJ, Havelin J, Tettelbach CRH*, Patricio RM. (2020). Attempted use of an uncommon bay scallop color morph for tracking the contribution of restoration efforts to population recovery. Restoration Ecology 28:532-542.

Grear JS, O'Leary CA*, Nye JA, Tettelbach ST, Gobler CJ. (2020). Effects of coastal acidification on North Atlantic bivalves: interpreting laboratory responses in the context of in situ populations. Marine Ecology Progress Series. 633:89-104.

Tettelbach ST, Peterson BJ, Carroll JM, Furman BT, Hughes SWT, Havelin J*, Europe JR*, Bonal DM*, Weinstock AJ*, Smith CF. (2015). Aspiring to an altered stable state: rebuilding of bay scallop populations and fisheries following intensive restoration. Marine Ecology Progress Series 529:121-136.

Tettelbach ST, Peterson BJ, Carroll JM, Hughes SWT, Bonal DM*, Weinstock AJ*, Europe JR*, Furman BT*, Smith CF. (2013). Priming the larval pump: resurgence of bay scallop recruitment following initiation of intensive restoration efforts. Marine Ecology Progress Series 478:153-172.

Tettelbach ST, Barnes D, Aldred J, Rivara G, Bonal D**, Weinstock A**, Fitzsimons-Diaz C**, Thiel J, Cammarota MC, Stark A, Wejnert K**, Ames R**, Carroll J*. (2011). Utility of high density plantings in bay scallop, *Argopecten irradians irradians*, restoration. Aquaculture International. 19(4):715-739.

Synergistic Activities and Achievements:

Member of Peconic Estuary Program Bay Scallop Task Force (2019-present)
Co-leader of the ongoing, 16-year "Restoration of Peconic Bay Scallop Populations and Fisheries" project, the largest of its kind in North America (2005-2020)
Mentor of students who conducted research on bay scallops: Ph.D. (served on 3 dissertation committees), M.S. (advisor for 7), undergraduate (15), high school (6) (1987-2019)
Invited reviewer of Nantucket Bay Scallop Management Plan (2012)

Karen E. Rivara
Phone: (631) 765-1808
Aeros Cultured Oyster Company
e-mail: Keeno1959@gmail.com
P.O. Box 964
Southold, New York 11971

EDUCATION: Bachelor of Science, Marine Biology, Long Island University, Southampton Campus, 1981.
Associate in Science, Accounting, Suffolk Community College, Riverhead Campus, 2001

EXPERIENCE:
2020 – President, East Coast Shellfish Growers Association

April 2000 – Present, *Secretary*, **Noank Aquaculture Cooperative**, Noank, Connecticut. Responsible for recording all business conducted at meetings. Responsible for all communication with outside contractors and government agencies. Oversee construction and operation of shellfish seed hatchery and nursery facility.

May 1992 - Present, *President,* **Aeros Cultured Oyster Company, Inc.,** Southold, New York and *Secretary/ Treasurer*, **Aeros Cultured Oyster Company, LLC**, Niantic, Connecticut. Produce and raise seed oysters, clams and scallops. Co-manage operation of shellfish grow-out operations in NY and CT. Assist in marketing of product.

February 1993 - December 1993, *Laboratory Supervisor*, **Pure, Healthy and Delicious**, Seaford, New York. Oversaw the day-to-day operations of the laboratory associated with a clam depuration facility.

May 1990 - October 1992, *Special Projects Supervisor* and *Laboratory Manager*, **Cosper Environmental Services, Inc.**, Bohemia, New York. Managed EPA certified bioassay testing laboratory which analyzes the biological toxicity of effluent from municipal and industrial wastewater treatment plants.

July 1988 - May 1990, *Production Manager*, **Shinnecock Tribe Oyster Project**, Southampton, New York.

July 1985 - July 1988, *Algae Production Manager*, **The Bluepoints Company**, West Sayville, New York.

March 1983 - July 1985, *Research Technician*, **The New York State Research Foundation**, SUNY at Stony Brook, Stony Brook, New York. Collected data related to the production of bivalve shellfish seed to determine the cost of operating a commercial scale oyster hatchery.

RELATED SKILLS: Foreign Language: Spanish - read, write and speak.

CERTIFICATION: PADI Certified SCUBA diver since 3/79. Hazard Analysis Critical Control Point (HACCP) 1/97.

MEMBERSHIPS: Interstate Shellfish Sanitation Conference, Long Island Farm Bureau- Board of Directors, New York State Aquaculture Association – Board of Directors, East Coast Shellfish Growers Association – Board of Directors.

MARTHA'S VINEYARD
SHELLFISH GROUP
1976

EMMA GREEN-BEACH

Biologist & Executive Director
emma.greenbeach@mvshellfishgroup.org
c: (508) 542-1339

EDUCATION

2007-2011: Masters of Science. Ecology & Evolution, Rutgers, the State University of New Jersey
2002-2006: Bachelors of Science. Biology, University of Massachusetts – Dartmouth.

RELEVANT EXPERIENCE

2017-PRESENT. **Biologist & Executive Director**. Martha's Vineyard Shellfish Group, Inc. Fundraising, facilities maintenance and operation of non-profit, public shellfish hatchery. Management of shellfish propagation, habitat restoration and shell recycling programs. Development of community connections through outreach and education. Maintenance of 501(c)3 status; personnel and fiscal needs. Advocacy for aquaculture; habitat and water quality protection. Management of 12 member Board of Directors.

2014-PRESENT. **Special Projects & Shell Recycling Manager**. Martha's Vineyard Shellfish Group, Inc. Fund, and manage projects to support shellfish habitat and good water quality. Coordinate shell collection from restaurants and subsequent deposit into salt ponds.

2011-2013. **Research Assistant II**. The Marine Biological Laboratory, Woods Hole, MA. Scientific Aquaculture program. Ran research scale hatchery for surf clams, quahogs, bay scallops, oysters, blue mussels. Tank and field culture of *Gracilaria.*

2007-2011. **Graduate Research Assistant**. Rutgers University, Haskin Shellfish Research Laboratory, Port Norris, NJ. Conduct research on oyster population genetics and pathology for M.S. degree. Assist in shellfish research laboratory dissections for genetics and pathology. Various field work.

PUBLICATIONS, PRESENTATIONS AND ABSTRACTS

Jamie Vaudrey*, Emma Green-Beach, Rick Karney. 2018. Evidence for nitrogen removal via phytoremediation with Phragmites. New England Estuarine Research Society meeting. March 2018.

Green-Beach, E. Brookstock selection for higher meat yield in the bay scallop, *Argopecten irradians*. Northeastern Aquaculture Conference and Expo. Jan 2017, Providence, RI.

Green-Beach, E.*, R. Karney, A. Surier and C. Edwards. Demonstration of Living Shoreline Technology on Martha's Vineyard, MA. Northeastern Aquaculture Conference & Expo. Jan 2015, Portland, ME.

Green-Beach, E., X. Guo, P. Smouse, D. Bushek. 2011. Population structure of oysters on Martha's Vineyard, MA in response to selection by *Perkinsus marinus*, using microsatellite markers. J. of Shellfish Research. Vol. 30(2) p512.

Morris, J., M.R. Carman, K.E. Hoagland, E. Green-Beach, R. Karney. 2009. Impact of the invasive colonial tunicate *Didemnum vexillum* on the recruitment of the bay scallop (*Argopecten irradians irradians*) and implications for recruitment of the sea scallop (*Placopecten magellanicus*) on Georges Bank. Aquatic Invasions 4(1): 2007-211.

RÉSUMÉ

RICHARD C. KARNEY
Shellfish Biologist & Director Emeritus
Martha's Vineyard Shellfish Group, Inc.
P.O. Box 1552
Oak Bluffs, MA 02557
(508) 693-0391 email: mvsg@comcast.net

Residence:
147 Oak Lane
Vineyard Haven, MA 02568
(508) 693-5131

EDUCATION

Rutgers - The State University of New Jersey Rutgers College
Bachelor of Arts in the Biological Sciences, 1972 Phi Beta Kappa

EXPERIENCE

1976 to 2017 — **Martha's Vineyard Shellfish Group, Inc.** <www.mvshellfishgroup.org>
Shellfish Biologist and Director
Duties include the design and implementation of a community development plan for the commercially important shellfish species on Martha's Vineyard. Management efforts are concentrated on the development of hatchery and field aquaculture methods for shellfish and operation of the nation's first public solar shellfish hatchery

.

2009-2013 — **Woods Hole Oceanographic Institution – Aquaculture Consultant**
"Development of Hatchery Based Shellfish Production in Zanzibar"

1998-2003 — **TerraAqua - Aquaculture Consultant**
"Oyster Farming for Chesapeake Watermen"
"Potential Impacts of Small-Scale Commercial Mariculture in Southampton Public Waters"

1992 & 1995 — **Woods Hole Marine Biological Laboratory - Contract Faculty Member, Consultant**

1973 - 1976 — **Virginia Institute of Marine Science**
Laboratory Technician
Assisted with the development of culture methods for the hard clam and bay scallop.

AWARDS

2001 Gulf of Maine Visionary Award by the Gulf of Maine Council on the Marine Environment

PROFESSIONAL ORGANIZATIONS

National Shellfisheries Association, Industry Committee Co-Chair (2001-2013), Member at Large (2003-2006), Vice President (2006)
World Aquaculture Society
Massachusetts Shellfish Officers Association
Massachusetts Aquaculture Association
East Coast Shellfish Growers Association

LOCAL AFFILIATIONS

Southeast Massachusetts Aquaculture Center, Board of Directors, Co Chair (2001-2020)
Advisory Board of Lagoon Pond Association, Member
Advisory Board of the Friends of Sengekontacket (Pond), Member
Squibnocket Pond District Advisory Committee, Member
West Tisbury Shellfish Committee, Member

Donald J. King II

275 Linden Ave.

Branford, CT 06405

Education:

BA in Geography, Clark University

BA Economics, Clark University

Graduate of Branford High School 1978

Past Experience:

18 years Licensed Captain 100 Ton

51 years commercial lobstermen

24 years commercial shellfish fisherman

13 years commercial shellfish farmer

9 years commercial seaweed grower

Current Positions:

Executive Board of the CT Sea Food Council

President Conn. Commercial Lobsters Ass.

Owner/ president D. J. King Lobsters Branford CT.

Captain 42' Lobster/Fishing vessel Kory Alexander

Logic Model of: Pales Espinosa et al (Development of resistant bay scallop strains for aquaculture in the Northeast)

Situation Statement: Bay scallop (*Argopecten irradians* subpsp. *irradians*) populations in the Peconic estuary (east end of Long Island, NY) have suffered severe mortality events in summers 2019 and 2020. Evidence suggests that the cause of the mortalities is a combination of temperature stress and infection by an Apicomplexan parasite dubbed bay scallop coccidia (BSC). This seed grant application is designed to test the hypothesis that the extensive selection pressure exerted by these large-scale mortality events resulted in the selection of resistant scallops.

Outcome Summary: A direct outcome will be the identification of bay scallop lines that can resist infection with BSC and heat stress. This information and associated biological resources will serve for the establishment of a regional bay scallop selective breeding program.

Inputs	Outputs		Outcomes – Impact		
	Activities	**Participation**	**Short Term**	**Medium Term**	**Long Term**
What we invest: Staff Partners Time Equipment Technology Biological resources Information	**What we do:** Breed 5 different scallop lines Test the resistance of these lines to BSC and temperature stress Secure the best lines Inform farmers and managers Train personnel	**Who we reach:** Participants The aquaculture community in the Northeast The aquaculture community nationwide Agencies Scientists	**What the short term results are:** Confirm that resistance to BSC and heat stress is a heritable trait Identify and secure the best performing scallop line(s) Maintain superior scallop broodstock	**What the medium term results are:** Initiate a bay scallop selective breeding program Adoption of the best performing scallop line(s) by growers and managers Promote the growth of the scallop aquaculture industry **Promote the diversification** of the shellfish aquaculture industry in the Northeast	**That the ultimate results are:** Robust and **diversified** aquaculture industry Availability of secure and safe seafood resources Social and economic development

Assumptions

Significant differences will be noted between tested scallop lines

External Factors

Changes in disease (and/or environmental stress) pressure in the field during the study

Evaluation - How will you measure and report your outcomes?

The ultimate long-term outcome is the growth of a robust and diversified shellfish aquaculture industry but short-term outcomes will include:

- Ability to produce the experimental scallop lines
- Detection of differential performance of different stocks in the various experimental areas and lab studies
- Maintenance of the best scallop line(s) lines
- Initiation of a bay scallop selective breeding program

This seed grant application will allow us to validate the premise that bay scallop resistance to BSC infection and heat-stress is a heritable genetic trait. In light of the increasingly frequent disease outbreaks and mortality events associated with climate change, our projected findings would represent a major breakthrough that will set the base for the development of a regional bay scallop selective breeding program. Throughout the study, we will inform stakeholders about our planned work and our findings, and we will use received feedback to re-shape and adjust our strategies.

Proposal: **Development of resistant bay scallop strains for aquaculture in the Northeast**

Pales Espinosa and Collaborators

Suggested reviewers:

Dr. **Carolyn Friedman**, Professor, School of Aquatic And Fishery Sciences, University of Washington, 1122 NE Boat St, Box 355020 Seattle, WA 98195-5020, Phone: (206) 543-9519, Email: carolynf@uw.edu
Dr. Friedman is a shellfish biologist with extensive work on shellfish aquaculture and health, including on the characterization of coccidian parasites in mollusks

Dr. **Steven Roberts**, Associate Professor, School of Aquatic And Fishery Sciences, University of Washington, 1122 NE Boat St, Box 355020 Seattle, WA 98195-5020, Phone: (206) 685-3742, Email: SR320@UW.EDU
Dr. Roberts is a shellfish geneticist with extensive work on shellfish health and resistance to environmental stress

Dr. **Jerome La Peyre,** Professor, Department of Veterinary Science, Louisiana State University Agricultural Center, Baton Rouge, Louisiana 70803, Phone: (212) 578-5419, Email: jlapeyre@agcenter.lsu.edu
Dr. La Peyre is a shellfish biologist with extensive work on aquaculture and health

Dr. **John Scarpa,** Associate Professor, Texas A&M University-Corpus Christi, 6300 Ocean Dr., Corpus Christi, TX. 78412, Phone: (361) 825-2369, Email: John.Scarpa@tamucc.edu
Dr. Scarpa is a shellfish biologist with extensive work on shellfish aquaculture

Dr. **Ami Wilbur,** Associate Professor, Director of UNCW Shellfish Research Hatchery, Center for Marine Science, University of North Carolina Wilmington, 5600 Marvin K. Moss Lane, Wilmington, NC 28409-5928, Phone: (910) 962-2389, Email: wilbura@uncw.edu
Dr. Wilbur is a shellfish biologist and geneticist with extensive work and hands-on experience with shellfish breeding for resistance against disease and environmental stress

Reviewers **not to consider** / Reason

Sandra Shumway, University of Connecticut / Conflict of interest with several members of the project team

Evan J. Ward, University of Connecticut / Conflict of interest with several members of the project team