

Report to the Joint Standing Committee on Marine Resources

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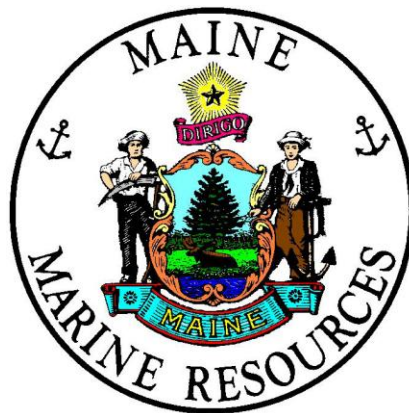
Regarding LD 1452 “An Act To Protect Areas in Which Shellfish Conservation Gear Has Been Placed for Predator Control and Habitat Enhancement Purposes and Establish a Municipal Predator Control Pilot Program”

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Introduction

During the Second Regular Session of the 126th Maine Legislature, LD 1452; “An Act To Allow Municipalities with Shellfish Conservation Ordinances To Request Permission To Prohibit Marine Worm Harvesting” was considered by the Joint Standing Committee on Marine Resources. The Committee held a public hearing on LD 1452 on January 22, 2014 which was attended by hundreds of harvesters, mostly from the worm industry who were opposed to the bill. Work sessions were held on January 22nd and February 12th. As a result of the work session, the Committee voted to amend the bill by striking the title and substituting the following: “An Act To Protect Areas in Which Shellfish Conservation Gear Has Been Placed for Predator Control and Habitat Enhancement Purposes and Establish a Municipal Predator Control Pilot Program”. The bill, as passed, has three sections; Section 1. prohibited the molestation of predator control gear, Section 2. established the predator control pilot project and Section 3. required a report from the Commissioner on predator control strategies.

After passage of the bill on April 5, 2014, the Department of Marine Resources (DMR) immediately established an application process for towns to request participation in the predator control pilot project program. Four towns were given permission by DMR to close specified intertidal areas to all harvest activity while they studied predator control methods. DMR staff reviewed the permitted projects several times during the field season and requested the towns present their findings at a workshop on December 9, 2014. DMR subsequently scheduled two stakeholder meetings, one in Boothbay Harbor on January 5, 2015 and the other in Ellsworth on January 8th. These stakeholder meetings were designed to provide input to DMR on predator control strategies and the needs of the soft shell clam and marine worm industries. This report is written to satisfy Section 3. of LD 1452 and help guide the Joint Standing Committee on Marine Resources with regard to further legislative action on the issues of both predator protection and the marine worm and clam industry conflict.

Predator Control Pilot Projects

LD 1452 was originally proposed by Senator Stan Gerzofsky as “An Act to Allow Municipalities with Shellfish Conservation Ordinances To Request Permission To Prohibit Marine Worm Harvesting”. The hearings on LD 1452 turned out hundreds of attendees, mostly marine worm harvesters who were adamantly opposed to the bill as written. DMR supported banning the molestation of predator control gear so that municipal efforts to actively protect bivalve shellfish resources were safeguarded, but did not support the request of municipalities to prohibit marine worm harvesting to benefit their shellfish conservation programs. LD 1452 was eventually implemented as: “An Act To Protect Areas in Which Shellfish Conservation Gear Has Been Placed for Predator Control and Habitat Enhancement Purposes and Establish a Municipal Predator Control Pilot Program” after the public hearings and workshops refocused the issue of depleted clam stocks on green crab predation not inter-fishery competition.

Section 1 of the approved bill states, that a municipality, as part of a shellfish conservation program, may place protective netting, fencing, traps or other gear in the intertidal zone. This gear must be clearly marked and a person may not tamper, molest, disturb, alter or destroy protective gear. A violation of this provision will lead to fines between \$300 and \$1000. This section does not sunset and remains in force.

Section 2 of the approved bill authorizes predator control pilot projects to determine the effectiveness of predator control strategies in increasing survival of soft shell clams and marine worms. The Commissioner approved four municipal projects (more could have been approved but not allowed to ban worm harvesting) in the late spring and early summer of 2014. Requirements for the programs included marking predator control gear, maintaining the gear and notification of closures and openings to both clam and marine worm industry members. Section 2. sunsets on February 28, 2015.

On April 18th, DMR sent notification to all towns with shellfish conservation programs regarding the passage of LD 1452 and the implementation of a predator control pilot program. An application form was attached to this notification, and a deadline for submission set as May 2, 2014. A total of six towns either submitted applications or expressed interest in the program. Four towns were eventually permitted as part of the program while the remaining two (Phippsburg and St. George) missed the deadline and withdrew their applications. The towns that were approved for the predator control pilot project included Brunswick, West Bath, Freeport and Harpswell.

Brunswick

DMR issued the first predator control pilot project permit to Brunswick on May 19th. The town requested closure of Woodward and Buttermilk Coves in order to compare the effects on green crab populations of fenced and unfenced areas in combination with trapping. Conditions of the permit included collecting catch and effort data for the trapping component and participation in the workshop at the end of the field season to present results. The project implementation date was delayed from an initial target date of June 1st to June 15th in order to provide time to communicate effectively with the marine worm industry. Initial notification had gone out from Brunswick to a marine worm dealer on May 29th stating that closures of Woodward and Buttermilk Coves would begin June 1st. This was deemed an inappropriate notification period (three days) and a delay was requested along with written notification to all marine worm dealers. Brunswick complied and the closures became effective June 15th.

DMR staff inspected the Brunswick LD 1452 predator control pilot project sites in early September. Biologist Peter Thayer reported that all structures, gear and signage were in place and maintained, for both Woodward and Buttermilk Coves. There was mention of a few minor incidents of worm harvesters going into the areas and signs being tossed, but no major enforcement concerns were raised.

Marine Resources Officer, Dan Devereaux participated in the Municipal Predator Control Pilot Project Workshop at the DMR office in West Boothbay Harbor on December 9th. He

presented findings including that the installation and maintenance of predator fencing was difficult and expensive. He stated that netting appeared to be effective in protecting soft shelled clams, but scientific evaluation had not been done and was not planned until the spring although the nets were removed. Officer Devereaux also reported that trapping can be successful, but the numbers of green crabs were much lower in 2014 v. 2013 so an evaluation of trapping effectiveness was difficult. The research was funded by the Maine Coastal Program and a municipal grant, totaling about \$55,000.

All participants of the workshop were asked two questions:

1. How effective do you think the predator control strategies were?

Officer Devereaux responded that predator nets were the best method because of low expense and relative ease of installation and maintenance.

2. What benefit did you observe as a result of the authority to prohibit other resource harvesting activities?

Officer Devereaux responded that this is still to be determined and will be based on the spring sampling to evaluate juvenile soft shelled clam survival rates.

West Bath

DMR issued a predator control pilot project permit to the Town of West Bath on May 20th. The original permit application did not meet the standards of LD 1452 and DMR consulted with West Bath on how to improve their project submission. The primary weakness of the proposal was a lack of specificity as to goals and objectives related to evaluating predator controls. DMR recommended a pre and post study resource survey. DMR was also concerned with the small budget (\$1000) and reliance on volunteer labor with regard to consistent implementation of the project. West Bath responded to DMR's concerns and the permit was issued. This permit allowed for the total closure of Browns Cove for the purpose of testing the effectiveness of easily replicated and implemented predator control programs (traps and nets). DMR staff did assist with a pre-study resource survey of Browns Cove, however the town removed the nets at the end of the study without contacting DMR or requesting assistance.

DMR staff inspected the West Bath LD 1452 predator control pilot project site in early September. Biologist Peter Thayer reported that all predator nets at Browns Cove were in place. Mr. Thayer cleared off some minor silt and algae on a few nets that required some maintenance. There was no visible signage for the closure, although further out along the cove there were a few trees marked with two white rings each – an indicator of No Trespassing. There were a few rectangular plots that were dug (~ 40x20' and 25x15') within the closure that were likely the result of worm harvesting. Mr. Thayer contacted the Town and told them the cove needs proper signage immediately.

The West Bath Shellfish Committee Chair, Warren Swanson participated in the Municipal Predator Control Pilot Project Workshop at the DMR office in West Boothbay Harbor on December 9th. He presented findings from the project including a determination that

trapping can work to reduce green crab numbers. He also indicated that the timing of setting out predator control nets is critical if you are trying to catch natural seed sets. All participants of the workshop were asked two questions:

1. How effective do you think the predator control strategies were?

Warren Swanson said that Browns Cove turned out to not be a major predator area and that just a few green crab traps were effective. He thinks nets would work if they were deployed early enough to catch natural seed sets. If the nets are deployed after the natural set and you are not seeding the area artificially then they are not worth the time or effort.

2. What benefit did you observe as a result of the authority to prohibit other resource harvesting activities?

The benefit is that it removed the variable of impacts of harvesting other species on the issues they were trying to study.

Harpswell

DMR issued a predator control pilot project permit to the Town of Harpswell on June 13th. The original permit application did not meet the standards of LD 1452 and DMR consulted with Harpswell on how to improve their project submission. The primary weakness of the proposal was a lack of evaluation criteria for the tested treatments. DMR recommended a pre and post study resource survey. DMR was also concerned with the reliance on volunteer labor with regard to consistent implementation of the project and any contingency plans if this model did not prove effective in maintaining the predator control gear. Harpswell responded to DMR's concerns with a significantly revised study plan and the permit was issued. This permit allowed for the total closure of Strawberry Creek for the purpose of testing if clam populations will naturally rebound once green crabs and milky ribbon worms are removed. The project also proposed testing clam survival and natural recruitment with various treatments including infrequent and frequent "roughing" and netting. DMR staff did assist with a pre-study resource survey of Strawberry Creek, however the town removed the nets at the end of the study without contacting DMR or requesting assistance.

DMR staff inspected the Harpswell LD 1452 predator control pilot project site in early September. Biologist Peter Thayer reported that eight green crab traps were visible in the channel and across mouth of the cove; there was also one large predator net deployed in Strawberry Creek. Signs were posted along the road notifying harvesters of the closure, but they were not readable due to water damage. Mr. Thayer emailed the town Marine Resources Coordinator requesting that the signs be replaced.

The Harpswell Marine Resources Coordinator, Darcie Couture participated in the Municipal Predator Control Pilot Project Workshop at the DMR office in West Boothbay Harbor on December 9th. She presented findings from the project including that milky ribbon worms were not plentiful (<6 observed) and green crabs were easily controlled with a few traps based on low population numbers. She also reported that pH did not vary

among study plots or with treatments (“roughing” v. undisturbed). Netting was viewed as an effective method for protecting seed clams and chronic disturbance results in low survival. Seed clams from a hatchery source were added to some of the study areas in September which will confound the ultimate results of this project.

All participants of the workshop were asked two questions:

1. How effective do you think the predator control strategies were?
Trapping is effective with low populations of green crabs and can provide protection to clam populations. Nets are also useful in increasing clam survival.
2. What benefit did you observe as a result of the authority to prohibit other resource harvesting activities?
Limiting harvesting as a variable was important so the treatments could be evaluated for the purpose for which they were designed.

Freeport

DMR issued a predator control pilot project permit to the Town of Freeport on June 4th. This permit allowed for the total closure of Staples, Spar, Recompense and Collins Coves as well as part of the shore near Wolfs Neck State Park. The objectives of this extensive project were to study the effectiveness of different shellfish protection methods and how to best enhance soft-shelled clam populations. This was done through a series of unique but related projects including, green crab fencing, enhancement using cultured clam seed, netting to enhance wild seed sets and survival and sediment buffering. This research was part of a large grant funded project conducted under the direction of Dr. Brian Beal of the University of Maine Machias and the Downeast Institute. The total project cost was estimated somewhere around \$250,000. Notification of the closures to the marine worm industry was done via a mailing to licensed marine worm dealers. The letter was dated June 4th which was the day the closures were implemented. One marine worm dealer reported not receiving the letter until six days after the closures were implemented.

DMR staff toured the Freeport research project in mid-June with Dr. Beal and later inspected the Freeport LD 1452 predator control pilot project site in September and early October. Biologist Peter Thayer reported that on September 23rd Staples Cove had all (14) wooden green crab fence structures intact. No green crabs were observed inside or outside of the fenced plots. There was considerable silting on the predator nets and minor algae coverage. There were also considerable numbers of mud dog whelks in the green crab fenced plots, only slightly less dense than outside the fences. Additional nets outside of the structures were all intact, with much less siltation than those inside the structures. No signs indicating the closure were visible around or within cove.

In Spar Cove five green crab traps were visible inside of old wooden barrier at the mouth of the cove. Eleven nets were observed outside of the fencing and all were intact. No signs indicating the closure were visible around or within cove.

Mr. Thayer visited the Wolfe's Neck site on September 25th and observed five green crab traps surrounding several large net groups. The nets were all intact and not much silting was observed overall. The couple traps he inspected had no crabs and no bait. Mud dog whelks were covering the entire area including residing on the nets. No signs indicating the closure were visible around or within cove.

Mr. Thayer visited the Collins Cove site on October 8th and observed 32 nets, all intact with only minor algae and silt coverage. No signs indicating the closure were visible around or within cove. He also visited Recompense Cove and observed 14 nets over raised mud, all intact with moderate siltation and algae. Corners of the overall study site were marked with moored buoys. No signs indicating the closure were visible around or within cove.

No representatives from Freeport participated in the Municipal Predator Control Pilot Project Workshop at the DMR office in West Boothbay Harbor on December 9th. However, a pamphlet summarizing all components of the project was shown to the workshop participants and Dr. Beal later answered the two questions DMR posed to all participants:

1. How effective do you think the predator control strategies were?
Fencing was difficult and expensive and generally not worth the time and expanse, netting is effective and trapping can be effective
2. What benefit did you observe as a result of the authority to prohibit other resource harvesting activities?
Limiting harvesting as a variable was important so the treatments could be evaluated for the purpose for which they were designed.

DMR Concerns With Implementation of LD 1452 Predator Control Pilot Projects

The most significant problem associated with the predator control pilot projects was related to timely and effective communication between the permitted municipalities and the marine worm industry. In three situations (Brunswick, Freeport and West Bath) notification of the closures were done on the day of or after the closures were already implemented creating obvious enforcement concerns. This lack of effective communication around total closure areas also inflamed the animosity between some members of the marine worm and clam industries. While Brunswick delayed their closure for two weeks after complaints from the marine worm industry, Freeport did not. West Bath mailed notification of the closure of Browns Cove on June 18th which was also the closure date. Harpswell mailed a notification letter to the marine worm dealers on June 23rd with an indication of the closure starting July 1st. The mailing included contact information and a map. DMR provided all permitted towns with mailing lists for licensed marine worm dealers and required them to provide notification of the closures through this avenue.

Another serious concern regarding the predator control projects was the lack of adequate signage at the closure locations. Only Brunswick has appropriate signs indicating the closures of Woodward and Buttermilk Coves, while Harpswell had unreadable signs and West Bath and Freeport had no signs indicating total closures of their permitted areas. In

addition, a town (Phippsburg) that was not permitted as part of the LD 1452 predator control pilot project falsely posted an area as closed under the provisions of LD 1452. Marine Patrol was notified and the signs were removed.

With the exception of Freeport, the other predator control pilot projects did not represent solid scientific investigations. Brunswick had a well-designed study that was effective in determining that green crab fencing is too labor intensive and not cost effective, as well as the success of green crab traps at low densities. However, they failed to evaluate the effectiveness of their predator netting because they removed the netting in the fall without conducting a post-treatment survey. Their proposed plan is to evaluate the survival of the clams in the formerly netted areas in the spring of 2015 which will confound winter mortality from both environmental factors and predation. Harpswell's study likewise was successful in determining the effectiveness of green crab traps at low densities. However, they implemented a study design without replicates, meaning they only had a single control plot and a single plot for each treatment type (rough once, rough twice weekly and netted). Furthermore, the approved project cited "roughing" as a treatment, but it appears this objective migrated toward a study of disturbance. Roughing is a practice where mud is raked lightly to increase surface area and complexity in order to increase recruitment of larval clams into the benthos. The Harpswell study did treat one plot with roughing, but then used one plot to study repeated disturbance (turning the mud twice a week). The objectives and conclusions of this treatment remain unclear although the effect of turning mud on pH was mentioned. Finally, Harpswell originally proposed studying natural recruitment, but added clam seed to their treatment areas in September. The rationale for this is also unclear and the addition of culture seed late in the study period clearly obfuscates any conclusions that could have been drawn on natural recruitment and survival. Finally, West Bath implemented a very basic study, but found that their deployments of nets were possibly too late to evaluate effect on recruitment and survival. Unfortunately, while they did avail themselves of DMR staff assistance on conducting a pre-study resource assessment they also removed the nets in the fall without notifying DMR or conducting a post-study survey. Therefore, results of these efforts are inconclusive.

Stakeholder Meetings

DMR hosted two stakeholder meetings; the first in West Boothbay Harbor on January 5th and the second in Ellsworth on January 8th. Notification of the meetings went out via email to DMR's public health listserve which includes all towns with municipal shellfish conservation programs, aquaculturists and shellfish harvesters, and to all marine worm harvesters with email addresses in the DMR database. Hard copies of the notification were also sent to licensed marine worm dealers. The objective of these meetings was to develop predator control strategies to mitigate the effects of green crabs in response to LD 1452 Sec. 3. with the cooperation of the soft shell clam and marine worm industries. The recommended strategies must identify the needs of the soft shell clam and marine worm industries and recognize that both industries have an economic interest in properly managing the intertidal zone in a way that does not disadvantage either user group. The outcome of these meetings is this report.

January 5, 2015 – West Boothbay Harbor:

More than 20 individuals attended the Stakeholder meeting on January 5th and the crowd was about evenly split between folks with primarily clam interests and those with primarily worm interests. Most of the participants came from the Brunswick to St. George region of the coast. The meeting started with a presentation by Kohl Kanwit, the Director of the Bureau of Public Health summarizing the history of LD 1452, the permitted pilot projects and then a discussion of the historic and current conflict between the marine worm and clam industries (see Attachment A). After the presentation the meeting was opened to discussion of predators and predator control strategies as well as possible solutions to the tensions between user groups.

Several participants said that it is not only the green crab that is a significant predator of soft shelled clams, there should also be attention paid to mud snails and seagulls. Others mentioned milky ribbon worms and moon snails, everyone agreed that hand removal is the only effective method at reducing these other predators. The crowd debated the best methods for controlling green crabs and all agreed that while fencing can work it is expensive and very labor intensive and in the end not worth the cost and effort. There was general consensus that traps and nets work although these also have to be tended regularly and their effectiveness with high population densities of green crabs is largely unknown. A DMR staff member mentioned that some towns have discussed using a drag to remove green crabs subtidally, but to his knowledge this has not been tried in the field.

When the conversation turned toward the needs of the soft shelled clam and marine worm industries there was agreement that any changes in management need to be based on factual data, not hearsay. Most agreed that more research was needed to evaluate the impact of predators and fishing activities on both clams and worms. It was noted that although LD 1452 stipulated that predator control pilot projects should determine the effectiveness of predator controls in increasing survival of soft shell clams and marine worms, none of the four projects evaluated any impacts to marine worms.

Invariably the conversation turned toward the conflict between the clam and worm industries. One individual attempted to clarify that sand worms and blood worms are different industries and should not be lumped together when accusations of damage to the mud flats are made. Many participants stated that it is not fair that the soft shelled clam industry is so regulated with state and town licenses, state and town closures, tagging requirements etc and the worm industry is “unregulated”. Clarification was provided that the worm industry is regulated by a state license, no Sunday digging and recreational limits. However, the comparison between regulations affecting the two fisheries is stark, especially regarding open worm license sales and no areas closed to worm harvesting. It was repeated several times that clam harvesters are restricted to their town boundaries and wormers can move wherever they like. This was viewed as an inequity by the clam harvesters and as an unnecessary, self-imposed restriction (election for town shellfish management) by the worm harvesters. One individual stated that either the towns should regulate worming or the town shellfish programs should be abolished. Another person

stated that if fishermen could be flexible again, moving among several fisheries (scallops, shrimp, groundfish, urchins, clams, worms etc) these conflicts would not happen. The impact of the two harvesting practices on the resources also caused controversy. Several clam harvesters commented that it is the intensity of worm harvesters repeatedly turning the same flat that causes the damage to clams and clam seed. Worm harvesters countered that they do not dig the same areas over and over; only inexperienced diggers would do that. They also stated that inexperienced clam harvesters repeatedly turn the same flats.

All participants seemed to agree that mud changes with turning regardless of which industry is doing it, it is impacted by flattening with air boats and ice scour or lack of ice scour in mild winters. Many people expressed concerns about dead mud and soupy consistency that doesn't favor either clams or worms. Everyone agreed more research on dead or dying mud would be beneficial.

Possible solutions were presented to the audience:

- Increased conservation activities (seeding, netting, surveys, harvest controls)
- Designated research areas closed to all harvest
- Research on the impacts of other harvest activities on clam and worm populations
- Documentation of harvesting practices for both clam and worm industries
- Municipal aquaculture

Most agreed that increased clam conservation activities could help increase clam populations, but they are also costly and time intensive. A comment was made that conservation activities (such as returning culls) are being done in the worm industry but are "off the radar". Everyone agreed that designated research areas would be beneficial to both industries as long as they are strictly defined, used and enforced. The worm industry members did not agree that something along the lines of the predator control pilot projects would be useful due to their largely poor execution by the municipalities. Research on the impacts of harvest activities on both fisheries was deemed important as was actual documentation of harvest intensity which could be done with harvester logbooks. The reaction to municipal leasing was mixed and many folks were hesitant to commit one way or another on this strategy. Participants suggested a possible solution be added for enhancement studies of both clams and worms. Another recommendation was made to evaluate the economic impacts of both fisheries and the significance of utilization (human food v. bait).

January 8, 2015 – Ellsworth:

Almost 20 individuals participated in the Ellsworth stakeholder meeting and was dominated by people who do both worm and clam harvesting. The tone was markedly different than the West Boothbay Harbor meeting. Most of the participants came from the downeast region although representatives from the shellfish programs for the towns of Brunswick and Harpswell also traveled to the Ellsworth meeting. As with the previous meeting, the meeting started with a presentation by Kohl Kanwit, the Director of the Bureau of Public

Health summarizing the history of LD 1452, the permitted pilot projects and then a discussion of the historic and current conflict between the marine worm and clam industries. After the presentation the meeting was opened to discussion of predators and predator control strategies as well as possible solutions to the tensions between user groups.

Not much time was spent discussing predators and predator protection strategies. Everyone agreed green crabs were a problem in some areas, as were moon snails and milky ribbon worms. Everyone agreed that netting and trapping can be effective for protecting clam resources if they are tended. Many folks expressed concerns that netting doesn't protect large areas and therefore the effectiveness for a commercial fishery is limited. Some also mentioned that netting is not effective for protecting worms because they move. Several participants said it is really Mother Nature who needs to control the green crabs with cold winters.

Discussions related to the LD 1452 pilot projects emphasized that communication from the permitted municipalities to the marine worm industry was inadequate. Many of the participants felt strongly that the real motivation behind LD 1452 was to give towns control of the marine worm fishery and thereby increase their influence and revenues. Everyone agreed that the conflict between the worm and clam industries was a local issue centered in the mid-coast region and should be solved locally. Most agreed that there were not significant conflicts between the two groups in the downeast region.

It was repeated several times in Ellsworth that clam harvesters are restricted to their town boundaries and wormers can move wherever they like. This issue was less contentious however since so many attendees participated in both fisheries. Many folks agreed that regional shellfish management programs like the Frenchman's Bay seven town partnership would benefit clam harvesters by providing more flexibility.

Everyone agreed that real science (replication and documentation) needs to support any changes in fishery management. Most also agreed that focusing on enhancement efforts would benefit both fisheries more than adding regulations. It was also emphasized that these fisheries (clam and worm) are vastly different and management tools that work for one will most likely not work for the other, this is primarily related to the fact that worms are mobile and not sedentary. They migrate and set into areas unpredictably so the local management framework does not fit the resource.

Possible solutions were presented to the audience:

- Increased conservation activities (seeding, netting, surveys, harvest controls)
- Designated research areas closed to all harvest
- Research on the impacts of other harvest activities on clam and worm populations
- Documentation of harvesting practices for both clam and worm industries
- Municipal aquaculture

Most agreed that increased clam conservation activities could help increase clam populations, but they are also costly and time intensive. A comment was made that conservation activities (such as returning culls) are being done in the worm industry but are “off the radar”. Everyone agreed that designated research areas would be beneficial to both industries as long as they are strictly defined, used and enforced. The worm industry members did not agree that something along the lines of the predator control pilot projects would be useful due to their largely poor execution by the municipalities. Research on the impacts of harvest activities on both fisheries was deemed important as was actual documentation of harvest intensity. The reaction to municipal leasing was mostly negative. Participants suggested a possible solution be added for enhancement studies of both clams and worms. These comments largely echoed those made at the West Boothbay Harbor meeting.

Conclusions and Recommendations

The implementation of the predator control pilot projects was somewhat difficult given the short turn around for development of application materials, submission of applications, evaluation of applications and eventual issuance of permits. While there seemed to be some utility in the projects, it was clear that funding and professional involvement of scientific personnel was key to the eventual outcome. For example, in Freeport the study results will be published in scientific journals and will provide valuable information for any predator control projects that follow. In contrast, Harpswell altered its study plans during the course of the project and confounded possible results by adding variables (hatchery seed in September) and provided no replicates of treatments. West Bath and Brunswick did not execute end of season surveys to evaluate the effectiveness of the nets in a quantifiable way. Brunswick is planning to do surveys in the spring, but this will confound results by adding winter mortality and possible integration of a fall set of clam seed. Based on the study results it is clear that predator netting and trapping are the best methods for mitigating the effects of green crabs on soft shelled clam populations. It is also clear that green crab fencing is costly and time consuming to set up, maintain and tear down. While it might be effective in keeping green crabs out of an area it is not deemed worth the expense and effort given the value of the resource it is protecting.

The execution of the total area closures was also problematic with notification in most towns done the day of or after the closure was implemented. Harpswell did issue a notice to the marine worm dealers with a map and contact information more than a week before the closure. Brunswick delayed their closure by two weeks after marine worm dealers expressed concern that they were notified three days before the closure. West Bath and Freeport made closures that day they mailed notifications and did not alter course. All of the towns with the exception of Brunswick also had signage issues. West Bath and Freeport has no signs posted at shore access areas while Harpswell’s were unreadable. Finally, there were also inconsistencies with tending gear. Several nets were observed to have heavy siltation and traps were observed without bait seemingly untended for a long period.

Although LD 1452 transformed from a marine worm harvest closure to a green crab predation bill the underlying conflicts between the two industries have persisted through the summer of 2014 and into the present. During the two stakeholder meetings that DMR hosted the second half of the presentation addressed the history of clam/worm conflicts and the reasons behind them. It is interesting to note that the clam/worm conflict is not a new issue and was addressed by industry and managers last in 1997. In August 1997 the Maine Soft Shelled Clam Advisory Council (MSSCAC) stated that the Clam/Worm Conflict “is a priority”, they noted that “some flats are being turned six times by wormers”. This discussion in 1997 was a re-visit of a conflict in the Brunswick area that resulted in DMR closing 1/3 of the town flats to worming in the early 1990s. Dr. Brian Beal conducted a study during this worm harvesting closure and published “*Short-term Effects of Commercial Clam (Mya Arenaria) and Worm (Glycera Dibranchiata) Harvesting on Survival and Growth of Juveniles of the Soft-Shell Clam*”. The conclusion was that mortality induced by either worm or clam harvesting on clams is virtually the same. In October 1997 the MSSCAC formed a Clam/Worm Conflict Resolution Working Group to specifically mediate issues in the St. George River. On March 16, 1998, MSSCAC reported that there were 6 meetings of the Conflict Resolution sub-group and many felt progress was being made. Recommendations were “limiting [first worm then all] harvest” and establishing a test site. There was general consensus that the worm industry would not react favorably to this plan. One participant in the meetings stated, “...there needs to be some data upon which to base any changes in policy or regulation”. On February 2, 2000 the Draft report of the Clam/Worm Conflict Resolution Workgroup was submitted to MSSCAC. They reported holding a total of 10 workgroup meetings. They proposed a three zone, 30 day rolling closure plan in the St. George which was implemented April 8, 1998. It was repealed April 30, 1998 because it was determined the work group process had “failed to represent the worm industry”. In the end a contact list of members of the marine worm industry was developed and was viewed as a “useful tool”. Based on recollections of people who experienced this last high conflict period, the issue was resolved when the worms were harvested or had moved out of the St. George.

The following recommendations were presented by the Clam/Worm Conflict Resolution Workgroup in their report and were revisited with the attendees of the Stakeholder meetings in 2015:

- Local conflicts are best resolved locally if possible
- Site specific conflicts that are not resolved locally should be addressed by the MSSCAC (would be the DMR Shellfish Advisory Council in modern times)
- DMR regulatory power should be a last resort, it will likely increase conflict rather than resolve it
- MSSCAC should use the contact list and reach out to the worm industry
- Face to face participation by the worm industry is essential
- Statewide legislation should be avoided

The participants of the West Boothbay Harbor stakeholder meeting didn't even get past the first bullet. Many representatives from the municipal shellfish programs vocally expressed that it would take legislative resolution to fix the conflict. The response in Ellsworth was

completely different with everyone agreeing that involving DMR and legislators is a last resort.

Of all the discussions and feedback that DMR received through the process in 2015, two conclusions were clear:

1. LD 1452 as implemented did not adequately address the underlying problem of resource conflict between the clam and worm industries although it did provide guidance that nets and traps are the most effective methods for controlling green crab predation.
2. The only thing both the clam and worm interests agreed on is that setting aside research areas that are closed to all fishing done under the authority of DMR would be beneficial in collecting real data to be used for possible future actions.