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**A Report
by**

**The Committee to Study the Establishment
of Lobster Hatcheries**

**submitted to the 119th Legislature's
Joint Standing Committee on Marine Resources**

December 28, 1999

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Introduction:

The 119th Legislature, under Resolve 21, charged the Department of Marine Resources with establishing a committee to gather information on the feasibility of establishing lobster hatcheries in each of the seven lobster management zones. The Committee met in the summer and fall of 1999 to address both the biological and economic viability of establishing hatcheries. Minutes from the Committee's meetings can be found in the appendix. This is the final report of the Committee.

Lobster hatcheries have been tried in several countries over the past century (Bannister and Addison, 1998). In Maine, there have been three hatcheries that have successfully raised lobsters. The Lobster Hatchery Committee reviewed the results of studies from New England and other parts of the world to examine the success of lobster hatcheries from both a biological and economic viewpoint.

The Lobster Hatchery Committee discussed three primary reasons why lobster hatcheries may be desirable in Maine. These reasons include:

1. Biological Benefits (stock rebuilding and egg production)
2. Educational Uses (community outreach and use in the lobster apprentice program)
3. Local Economic Contributions (employment)

The primary reason was a desire to contribute more lobsters to the population and serve as a way to satisfy the National Marine Fisheries Service goal of F 10% egg per recruit for the lobster fishery.

Hatcheries and the Egg per Recruit Model for Lobster Management ***(by Dr. Bob Steneck, Darling Marine Center)***

If hatcheries were able to enhance lobster stocks, how would this affect the egg per recruit definition of overfishing? To answer this, you first have to understand what overfishing means and then consider if hatcheries can help.

The lobster fishery in Maine is managed to avoid an overfished state called "recruitment overfished". Recruitment overfishing happens when the broodstock has been so depleted that it cannot sustain the population (i.e., not enough reproducing lobsters are being added). The calculation to determine if a stock is recruitment overfished is complicated and is based on the egg per recruit (EPR) model. The EPR model is designed to estimate the likelihood of any female lobster born actually making it to reproduction. The model assumes that if there is no fishing taking place all lobsters born would live to reproduce except a small fraction that die of natural causes. In practice, however, fishing mortality is determined by calculating the abundance of lobsters just below and the abundance of lobsters just above the gauge for minimum harvestable size (3 ½"). The number of lobsters actually reaching reproductive size is then compared to the number of lobsters you would have *expected* to reach reproductive size based on the abundance of lobsters counted below the gauge. The logic is that if there was no fishing at all, most of the lobsters that are one or two molts under the minimum gauge would survive over the next five or so molts to reach a reproductive sized female. Trawl data has

indicated that a relatively low percentage of lobsters reach reproductive size and this is cause for concern that fishing mortality rates are too high. Fishing mortality rates (signified by the letter “F”) that are so high that less than 10% of the population will survive to reproductive size is the current definition of “recruitment overfishing”, also sometimes referred to as F 10%.

Why Hatcheries Probably Won’t Help the EPR (F 10%) Overfishing Status

The concern among managers is *not* that there are not enough juvenile lobsters. The concern is that the mortality rates are too high. It is widely acknowledged that the annual number of juvenile lobsters has increased steadily over most of the past decade and this is why the number of recruits to the fishery has increased.

Since the problem is not that there is a shortage of juvenile lobsters, but that too few juveniles survive to reproductive size, then producing more juveniles in hatcheries won’t help unless the number of legal sized lobster caught remains the same. The number of lobsters stocked would have to be on the order of billions to affect the calculated egg per recruit percent. Unless the egg per recruit relationship changes, there is still too small a percent of individuals in any year class that make it to reproductive size. The egg per recruit relationship is currently the only approved measure of recruitment overfishing, although others are being considered. Using the EPR measure, hatcheries cannot reduce overfishing concerns.

Reviewing the Success of Hatcheries in the United States, Canada and Europe (based on a lecture by Steneck, 1999)

- Massachusetts: The longest running hatchery in the United States was the Massachusetts State lobster hatchery that ran from 1949 to 1998. At its peak, the Massachusetts hatchery released 500,000 stage IV post larvae in one year. The facility had two full time and four part time operators with combined salaries of almost \$100,000 per year, although the annual operating costs for the facility were never calculated. In 1998 the state of Massachusetts halted the operation of the hatchery because there was never any evidence of its success and today it serves as a basic research facility.
- Cutler: The Cutler hatchery was a community-based public stock enhancement program in Cutler, Maine. From 1986 to 1991 the hatchery released stage IV and V lobsters, reaching an annual maximum of 170,000 lobsters. The annual operating cost of the hatchery was between \$25,000 and \$30,000 with many additional volunteer hours. In 1990, 1,500 stage IV blue lobsters were released in the Cutler area and were tracked to see how many were recaptured. By August of 1999, 40 blue lobsters had been reported caught by local fishermen, a 2.7% survival to recruitment size. Using these figures, this gives a value of the hatchery-released recruits of between \$10,000 and \$20,000, a net loss.
- Canada: The Magdalen Islands in Canada have lobster landings of 1800 tons annually. Waddy and Aiken (1998) calculated what would be required to enhance the stocks in that area by 10%. To begin, four thousand egg-bearing female lobsters would be needed to

produce 16,000,000 stage I larvae (4,000 – 8,000 lobsters per liter rearing chamber or 40 liter larval rearing chambers). Based on a 25% survival rate from stage I to stage IV, this would produce 4,000,000 stage IV post larvae being released into the area. These numbers would produce 400,000 recruits to the fishery assuming a 10% survival and complete retention to recruitment. They concluded that “enhancement is generally regarded as an ineffective tool for increasing landings in all but the most depleted fisheries.”

- Ireland: In 1993 Ireland had virtually no lobster fishery at all, but has since gone on to be the country to put the most gross national product into hatcheries than any other. In 1993, 32,000 stage IV lobsters were released and in the following year 132,000 stage IV lobsters were released. In order to improve the chances of survival, the hatchery released 45,000 stage V lobsters in 1995 and another 45,000 stage V lobsters in 1996. The survival rates of hatchery-reared larvae from 1993 to 1996 were as follows: stage I to IV was 40%; stage IV to V was 50%; and the number of recaptures is still unknown.
- Scotland: In Orkney, Scotland, between 1994 and 1999, survival of hatchery-reared larvae from stage I to VIII larvae was 13%. The rate of recapture is unknown but assumed to be between 4% and 5%. Releases from the Orkney hatchery were 400 stage IV lobster in 1994, 5,500 stage IV lobsters in 1995, 12,000 stage IV lobsters in 1996, 11,500 stage VIII lobsters in 1997, 30,000 stage VIII lobsters in 1998, and 50,000 stage VIII lobsters in 1999. The costs to operate the hatchery include the full time salary for someone to run the hatchery (\$15,000/year), which is far less than US salaries. In addition, the price per pound for lobsters in Scotland is around \$5 - \$10 per pound. Therefore, it may be economically viable to continue the hatchery in Scotland where a similar effort in the US would be an inefficient use of funds.
- England, Wales & Scotland: In this case study, all lobsters were kept in the hatchery until they were large enough to tag with a microwire tag, thus ensuring a better chance of the lobsters staying in the area. The releases occurred from 1983 to 1990 and the recapture data is from 1985 to 1994. In Bridlington, East England of the 49,128-tagged lobsters that were released 0.5 to 2.5% were recaptured. The recapture rate in Aberystwyth, Wales was slightly higher at 1.2% to 5.0% of the 19,233-tagged lobsters that were released. In Ardtoe, West Scotland 0 to 5.5% of the 3,044-tagged lobsters released were recaptured. And in Scapa Flow, North Scotland the recapture rate was between 0 and 4.8% of the 19,520-tagged lobsters released. On average, therefore, a 2 to 5% recapture rate is realistic to achieve.

LIFE HISTORY STAGE

Egg bearing lobster to hatch
 Stage I Larvae to Stage IV post larvae
 Transportation mortality
 Release
 1-month
 1 to 2 years
 Recruitment to the fishery
 Reproduction

SURVIVAL (Concerns)

Handling losses (deplete wild stocks)
 3 to 50% survival
 95% survival
 High survival
 10% recovered
 0 to 7% (Average is less than 3%)
 Have succeeded but % survival is unknown

Requirements for a Successful Lobster Hatchery and Rearing Techniques:
(by Jill Fegley, University of Maine Sea Grant Legislative Fellow)

A lobster enhancement facility requires a high quality seawater system. Recirculated seawater can be used but it must be maintained at high quality standards. All critical systems such as pumps, electrical supply and heating units require duplication and backups. Personnel must be well trained and diligent about following strict protocols to avoid loss of the stock.

It takes approximately 60 days to raise a lobster from hatch to stage IV using ambient seawater. A duration as short as 14 days to stage IV is possible if the seawater is heated to 68°F which is the optimum temperature for enhancing larval lobster growth (Beal, 1986).

Most hatcheries use a semi-closed system to rear the lobsters. Unfiltered seawater is pumped into the hatchery and then heated to 68°F. The heated seawater is then delivered to a conical-shaped larval rearing tank. The larval tanks are aerated for 48 hours and then the lobsters are removed and placed in another tank of fresh, heated seawater. This technique precludes major problems with water temperature, salinity, pH and dissolved oxygen. The systems need to be replenished every two days because nitrate levels begin to approach saturation. This technique was used in the Cutler hatchery and at the Massachusetts hatchery and is currently being used at the Ireland and Scotland hatcheries.

From hatch-out, lobsters are cannibalistic and will freely feed on each other, creating unique culture problems. In the hatchery, predation is controlled and the juveniles are discouraged from cannibalism by being kept separated (through the use of continuous bottom injection of water to keep the lobsters apart in the water column) and by being extremely well fed. Costs associated with maintaining physical separation and diet requirements, along with the length of time till maturation, have prevented lobster farming from being a viable economic possibility for aquaculture in Massachusetts.

Lobsters maintained at 70 degrees all year long take five to seven years to mature. At this temperature, diet demands increase. Further research is necessary to develop an economically viable food source for lobster culture. Releases of stage IV juvenile larvae typically began in mid-June and concluded in mid-November at Cutler Lobster Hatchery. The most successful releasing technique uses divers to place the lobsters in suitable sites and protect them from early predation.

Conclusions:

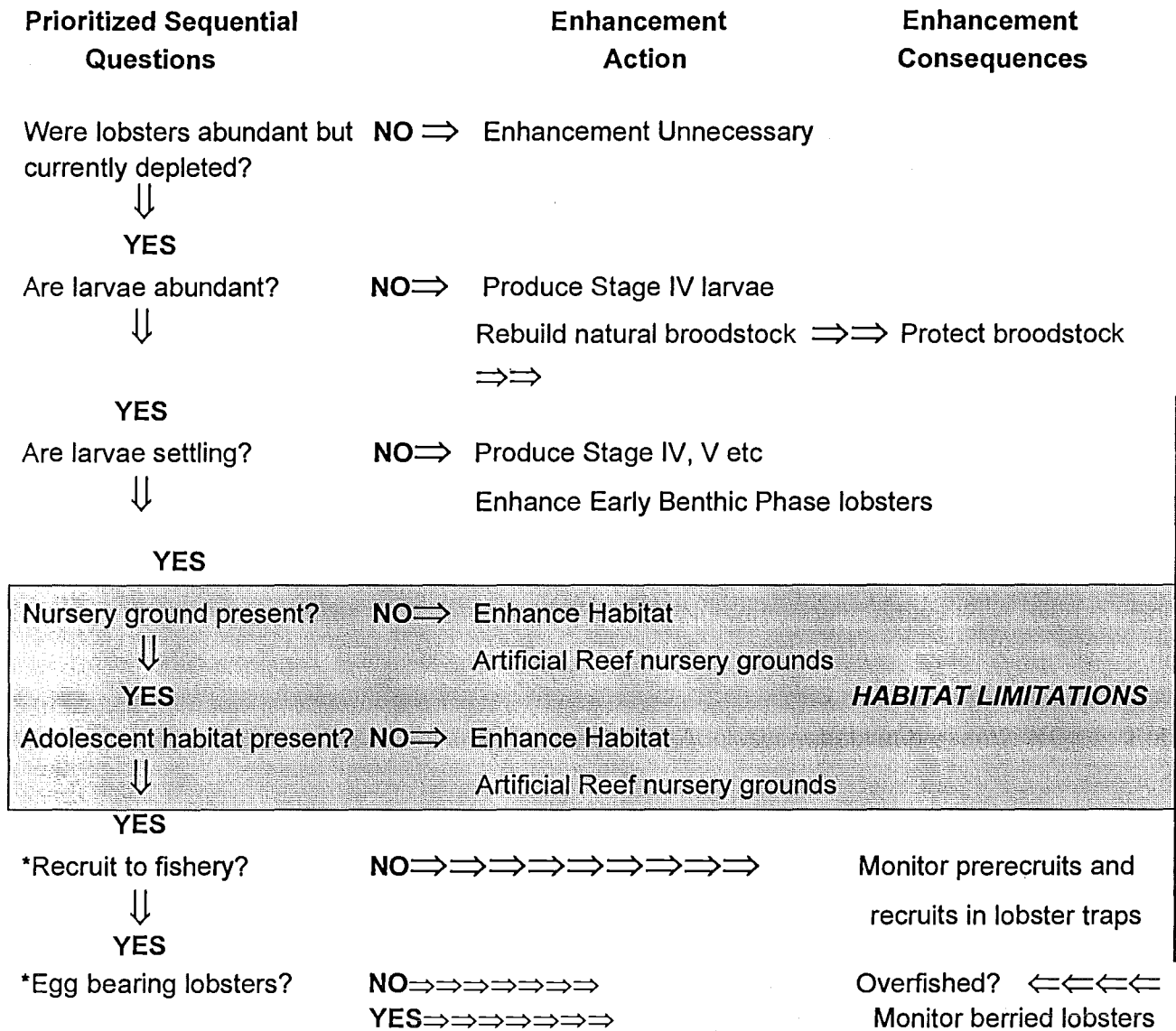
Based on the survival rates of the case studies, the cost per effort of the Cutler hatchery was estimated (Steneck, pers. comm.). If the hatchery were to produce 300,000 stage IV lobster as proposed in 1994, an estimated 5% recovery would translate into 15,000 lobsters at 1 ¼ pounds. Averaging \$3.50 per pound would give about \$65,000 worth of product. The initial annual cost of the hatchery would be roughly \$100,000 based on all operating costs (see figures by Jill Fegley in appendix). These numbers were considered very optimistic. In fact, 90% of all hatcheries have ultimately been closed because it has never been demonstrated that they contribute a significant amount to the natural population. In order for a hatchery to be economically viable for purposes of stock enhancement, the current stocks must be severely depleted. If not, the cost of raising lobsters to stage IV is more expensive than the profits from selling the lobsters that survive into adulthood. In Maine because stocks are currently in a healthy state, billions of larvae would need to be released in order to have an impact on even a small cove or bay. Although enhancement is possible for severely depleted areas, management is the best policy. (See flow chart on following page).

The hatcheries that have remained open have been used primarily for research and educational purposes. The Lobster Hatchery Committee discussed the research needs of the lobster industry and it was suggested that a hatchery could be used for research purposes to determine how greater recruitment success could be gained. A research program with a controlled release site, where the impacts of the hatchery and the necessary scale could be determined, may be useful. It was also noted by the Committee that hatcheries could be used as a valuable educational tool for the lobster apprentice program.

Recommendations:

1. It is not feasible at this time to establish lobster hatcheries in every zone for purposes of stock enhancement due to the cumulative costs of multiple hatcheries.
2. Some lobster hatcheries should be encouraged for both educational and research purposes. The merits of a separate fund for these purposes should be investigated.
3. Controlled release of hatchery-reared lobsters at specific sites should be required to begin to track the recruitment of these lobsters into the fishery to demonstrate the effectiveness of hatchery stock enhancement.
4. Research regarding other ways in which the industry could contribute to sustaining the current health of the lobster stocks should be supported.

Lobster Enhancement Actions and Consequences (Steneck, 1999)



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Appendices

**Committee to Study the Feasibility of Lobster Hatcheries
in Maine's Lobster Zones**

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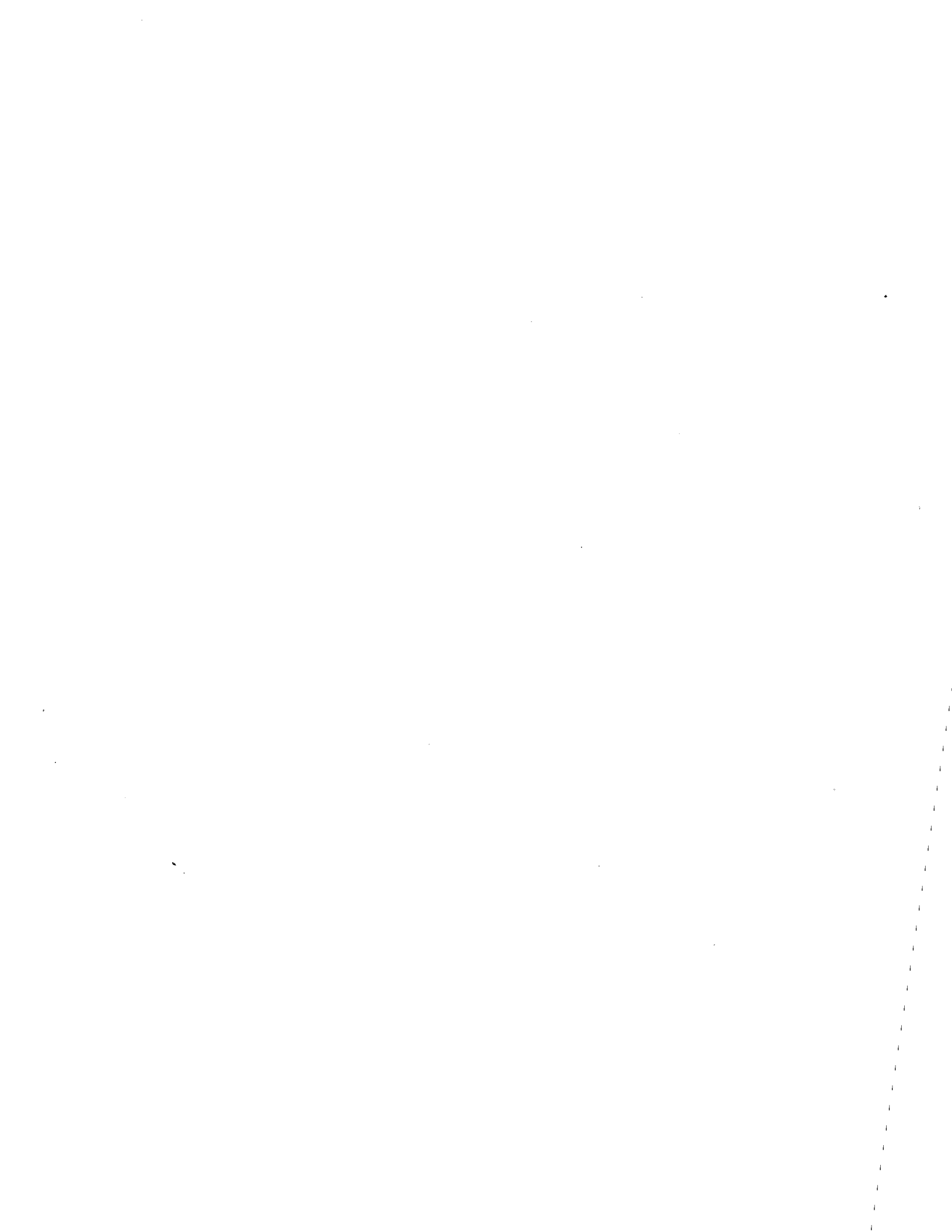
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**Committee to Study the Establishment of
Lobster Hatcheries in Maine**

Minutes

**September 2, 1999
Department of Marine Resources, Hallowell**

Present: Nick Lemieux (Zone A Rep.), Clive Farrin (Zone E Rep.), David Wessell (Zone F Rep.), Stephanie Nadeau (Zone G Rep.), Penn Estabrook (DMR Rep.), Rob Horne (Public Rep.), Jill Fegley (Maine Sea Grant Fellow), Laura Taylor (DMR staff), and Jennifer Smith (DMR staff)

The meeting convened at 2:06 PM.

Introductions

Laura Taylor began the first meeting of the Committee to Study the Establishment of Lobster Hatcheries (Committee). Introductions were made around the room. L. Taylor said any questions regarding the Committee can be directed to her at 624-6576 or laura.taylor@state.me.us.

Task Force Charge from the Legislature, "biological and economic viability of establishing hatcheries"

L. Taylor stated that the duties of the Lobster Hatchery Committee were to gather data to assess the feasibility and cost of establishing hatcheries in Maine and write a report on this for the Marine Resources Committee of the Legislature by December 31, 1999. Penn Estabrook stated that any other points relevant to lobster hatcheries could be included.

Elect Chair

L. Taylor asked the attendees to elect someone (or themselves) to serve as chair for the Committee. Nick Lemieux offered to serve as chair. Clive Farrin seconded the motion. All present agreed to having N. Lemieux as chair.

Overview of Hatcheries in Maine

P. Estabrook stated that hatcheries are not new to Maine. For several years the DMR facility in Boothbay Harbor had a hatchery. Most recently in the late 1980's and early 1990's, four different hatcheries were sponsored, including the Cutler hatchery. P. Estabrook ask N. Lemieux if the Cutler hatchery building is ready for a hatchery again. N. Lemieux stated that it was, it just needed staff and funding.

Stephanie Nadeau asked what has happened in the past with lobster hatcheries. P. Estabrook stated in 1986 the seed fund was amended to make lobster and seed hatcheries available. In 1987 or 1988, the Lobster Advisory Council allotted \$40,000 for lobster hatcheries, but in 1990 the Lobster Advisory Council voted not to sponsor the hatcheries because they believed the money was needed more for the Seed Lobster program.

S. Nadeau asked N. Lemieux what is needed for a lobster hatchery facility to run. N. Lemieux replied that tanks were needed to breed not only lobster, but for brine shrimp to feed the lobsters, and algae to feed the shrimp. Circular tanks with circulating pumps were needed for the lobster to keep them from killing each other, as well as pumps to bring fresh saltwater in from the ocean. He stated that many different tank sizes were needed for the different sizes of lobster. N. Lemieux also stated that any facility would need a full time manager, and part time staff in the summer months. He stated that a generator for power failure back-up is also important. N. Lemieux stated that in the last year of the Cutler hatchery, 300,000 stage four lobster were released. *[Revised to 140,000 stage four lobsters per N. Lemieux at 9/30/99 meeting.]* He stated that it took a long time for the hatchery to get to that level, but the past hatchery data is available to improve new hatcheries.

Why do we want lobster hatcheries in Maine and discussion of initial informational needs

N. Lemieux stated that he believed it would be beneficial to have a lobster hatchery in every zone along the coast. C. Farrin asked if the past manager from the Cutler hatchery would be available to manage a new hatchery. N. Lemieux stated that he was not available, but that he had stated he would be willing to help set up a new hatchery. N. Lemieux stated that hatcheries would create good part time summer jobs. C. Farrin stated that a good way at keeping costs of hatcheries down would be to tap the fishermen as a resource. He stated that making part of the lobster apprenticeship spending time working in a hatchery might be a good idea. He stated that he also thought using the school system for volunteers and for help getting things built was another way to keep costs down.

S. Nadeau stated that the technology in the past ten years has greatly improved. She stated that from a dealers perspective, she favors a refrigeration system. Using a controlled tank system would decrease a lobster's metabolism and therefore slow cannibalism. N. Lemieux asked about the cost of the refrigeration systems. S. Nadeau stated she did not have an exact figure, though she knew systems could be expensive, but that in the long run they could be very cost effective.

Rob Horne asked if anyone knew what effect putting the lobsters into the ocean had on them. C. Farrin stated he would also like to know what happens to an 1/8" lobster if you move it from 45 degree water to 65 degree water. S. Nadeau stated that the colder the water, the less the lobsters will eat. C. Farrin stated that slowing down the metabolism of the lobster by refrigeration would also mean they would not grow as fast. N. Lemieux stated that in the circular tanks the lobsters are not even close to each other.

P. Estabrook stated that there are some hatcheries in Great Britain and in France that the Committee should find more information about. He stated that the background on the cost and operation of these hatcheries could be useful information.

P. Estabrook stated that it would be valuable to answer the question *why* there is a need for hatcheries in the lobster industry. He stated that this was not in the mandate from the Legislature, but it would be valuable to have the analysis and to adopt a statement on why hatcheries are needed in Maine.

C. Farrin stated that if the Committee shows hatcheries viable, then they would have to be incorporated in the F-10. David Wessell asked if comments were available from the NMFS. C. Farrin stated that he would like to see figures. He would like to see what will happen in five years, how does it help F-10 without gear restrictions and moratoriums.

P. Estabrook stated that the Committee should locate someone to demonstrate the effect of hatcheries on the F-10 goal. He stated that information on why the lobster advisory council originally denied the program would be helpful. He also said that the Committee should look in to new tagging procedures as a way of tracking hatchery lobsters. N. Lemieux stated that in 1990, 220 blue Stage 4 lobsters were released in to the Cutler Harbor and that 25% of these lobsters have been recovered. D. Wessell stated that hatcheries could be a good way to bring back the "dead areas," where there are no lobsters being caught. P. Estabrook stated the information he had read from the hatcheries in England showed that Stage 4 lobsters were too small to release back. He said that they show Stage 6 lobsters as having a better chance at survival. He suggested that the Committee look into the cost effectiveness and feasibility of keeping lobsters into later stages. N. Lemieux stated that Stage 1 to 4 lobsters may not be going directly to the bottom and that a Stage 5 or 6 lobsters might be more likely to settle on the bottom. N. Lemieux stated that the bigger they grow in the hatchery, the more expensive it gets to keep them, and the bigger they grow the more that will be lost in the hatchery due to cannibalism. P. Estabrook suggested that the Committee have someone come in to speak on some of the size questions, possibly Bob Steneck will be able to attend the next meeting.

S. Nadeau stated that an answer to *why* is money, return on investment, impact on the local economy. D. Wessell stated that hatcheries are needed to guarantee a sustainable fishery. He stated that many people are concerned, though, with too many lobsters, that disease and other things could have a negative long term effect on the fishery.

P. Estabrook commented on the Seed Program and how it was criticized for only putting seed back in where it was caught. He stated that the Committee needs to look at where to place hatcheries along the coast to best benefit everyone in the fishery. Should there be one hatchery for the whole state, or should there be multiple hatcheries, possibly one in every zone? C. Farrin asked if anyone had seen numbers from the hatchery in Bar Harbor and stated that maybe the Committee should tour the hatchery there. P. Estabrook stated that the information would be gathered and a tour would be looked in to with a possible tour of the Massachusetts hatchery as well.

C. Farrin stated that a hatchery would also provide tremendous educational value. D. Wessell commented that the fishery could consider asking the Colleges and Universities to become involved in order to minimize cost.

S. Nadeau asked if anyone had information on the lobster habits and cycles. C. Farrin stated that there was an abundance of research on the lobster fishery. N. Lemieux stated that this information needed to be gathered because it was crucial to a lobster fishery. P. Estabrook stated that the location a lobster is placed into the ocean is crucial. Studies he has read indicate that cover is needed, and that it is needed to take lobster down and place them for survivability. P. Estabrook stated that the Committee needs to profile the elements of cost and work on the numbers of survivability. N. Lemieux stated that the Cutler hatchery was set up in the 1980's. The DMR cut the funding of the hatchery in 1991. In the last year of operation, 220 blue Stage 4 lobsters were released; 25% of these lobsters were later harvested at legal size. At a 25% survival rate, with a hatchery cost of 3.6¢, for a total cost of 14.4¢/lobster.

N. Lemieux asked about funding for a hatchery program. Will a fund for hatcheries be separate, or will it be part of another program? P. Estabrook stated that funding would have to be passed by the Legislature, and that they would put aside separate money in the statutes for a lobster hatchery. He stated that the Seed Fund Program would have to be kept separate. P.

Estabrook stated that a hatchery fund could be non-lapsing, and would be used only for funding hatcheries. N. Lemieux stated that a list of what is needed to run a hatchery should be composed (i.e., costs, equipment). S. Nadeau stated that she could provide some information on the cost of refrigeration systems. D. Wessell asked if N. Lemieux was opposed to fresh ocean water system. N. Lemieux said no.

S. Nadeau asked if there were any other places to obtain funding. P. Estabrook replied that there were probably no other funding sources. S. Nadeau commented that the funding does not seem supportive from the Legislature for such a large industry. P. Estabrook noted that the broad attitude of the Legislature is that the industry should support its own industry in terms of general fund tax support. P. Estabrook stated that they would contact a representative from the NMFS and the Technical Committee and invite them to attend the next meeting.

L. Taylor composed the following lists from the Committee's discussion:

Information/Research Needs

- How do hatcheries effect F10?
- How many lobsters can we put in the water based on experience?
- How are other places using new methods to run hatcheries (Great Britain)?
- What is the survival rate based on stage released?
- What has Chris Henig found in Portland Harbor?
- How far do lobsters travel?
- Do lobsters adapt in areas they are not grown?
- What is MDI Hatchery raising? At what cost? What are recapture rates?
- Could we get colleges/universities on board to keep costs down?
- What is the status of existing hatchery facilities?
- Are there new methods to track released lobsters?
- Possibility of putting lobsters in "dead areas"?
- Possibility of chemically treating released lobsters like in shad hatchery to track?
- Is there a maximum population density?
- Would this fit into the Gulf of Maine Aquarium's plans (i.e. education/research)?
- Harbor Branch - use of closed systems?
- Are there other sources of funds beyond state \$?

Questions

- Do we need a hatchery in every zone? If not, where?
- How much will it cost? List ALL cost factors, ALL items needed to run hatchery
- How would it be funded? Separate fund? How much?
- What scale do we need?

WHY?

- "To fight back egg production mandate"
- Contribute to F10
- Use as a teaching platform
- Support local economy
- Guarantee a healthy sustainable fishery
- As a tremendously valuable educational tool

Establish future meeting schedule

The Committee determined the next meeting is scheduled for Thursday, September 30, 1999, at 3:00 PM in the Hallowell third floor conference room.

The meeting adjourned at 4:15 PM.

Lobster Hatchery Information
Jill Fegley, Sea Grant Legislative Fellow, University of Maine, Orono
9/22/99

The following information is being presented to the Lobster Hatchery Committee to further elucidate some of the issues surrounding lobster hatcheries. The information provided is by no means comprehensive and will be updated as more information is gathered.

Biological Information

Habitat and Migration:

Early benthic stage lobsters (5-40mm CL) require shelter-providing habitats (primarily cobble). Cobble comprises only 11% of the Maine's shoreline and could limit lobster recruitment (Wahle & Steneck, 1991).

As lobsters get older / larger and reach the adolescent phase (1-1/2" to 3-1/2" CL) they live in areas with larger boulders, remain under cover during most of the day and go foraging at night .

Reproductive size (greater than 3-1/2" CL) adult lobsters appear to be less shelter dependent than the other two phases . They usually inhabit deeper water and can migrate long distances.

“Dead areas” could possibly be repopulated as long as suitable substrate (cobble) or habitat is available and there are no other “biological” reasons (e.g. sedimentation, lack of nutrients, food etc..) for not using the “dead areas”.

Most inshore lobsters migrate closer or further from shore depending on the seasons. They may move up to five or six miles in a year, going closer to shore in warm weather, and offshore to stable, deeper water in late fall. Offshore lobster stocks may move greater distances.

The highest reported densities of naturally recruited lobsters is 4 / m² (Wahle, 1991).

Natural Survival:

Less than 1/10 of 1% of the young lobsters that hatch will survive in the natural environment through the fourth molt stage as estimated by the Mass. Division of Marine Fisheries.

Vulnerability to predation declines dramatically with an increase in body size. Demersal fishes and crabs attack new settlers within minutes if they did not find shelter. (Wahle & Steneck, 1992).

Most losses (~80%) occurred within 24 to 48 hours of released stage IV blue lobsters over several years of experimentation by Wahle and Inze. In spite of high stocking densities, numbers quickly leveled-off at densities similar to the highest reported densities of naturally recruited lobsters (4/m²). Once settled there is a tendency for the new recruits to be sedentary.

Hatchery Information

Hatchery Success:

60 – 80% of the reared stage I lobsters survive to stage IV.

Lobsters raised to stage V in Shetland, Scotland had a 25% mortality rate following the stage IV molt. Beginning in 1999 they have funding to rear and release 30,000 stage V lobsters per year for 5 years (Watt & Arthur, 1996).

It takes approximately 2 weeks to raise stage IV lobsters in culture conditions. It takes an additional 2 weeks for the stage IV lobsters to reach stage V. The culture time required between molts increases with age.

Data regarding the success of hatchery reared lobsters recruiting into the fishery is still lacking.

Tagging/Tracking:

Lobsters must be marked in some way so that researchers will know how many hatchery-raised animals are trapped to determine whether hatcheries are effective. Most hatchery-raised lobsters are ready to be released in two weeks (stage IV). Lobsters can be marked with a microwire tag but they must first be raised until they are three or four months old. Microwire tagging is also a very tedious method when there are thousands of lobsters to tag. Specialized equipment is necessary to detect lobsters that carry microwire. This would make it difficult for fishermen to identify which lobsters in their traps were raised in a hatchery.

Plastic tags coded with individual numbers have long been used to document where lobsters are released and captured. However, after one or two molts the tags fall off, and they can only provide information on the lobsters' destination, not how they got there.

Since 1993 the University of Rhode Island has released 6,000 undersized, tagged lobsters and to date only 400 tags have been returned (a 7% recapture / survival rate).

Rearing Techniques:

It takes approximately 60 days from hatch to reach stage IV using ambient seawater. A duration as short as 14 days to stage IV is possible if the seawater is heated to 68°F which is the optimum temperature for enhancing larval lobster growth (Beal, 1987).

Most hatcheries use a semi-closed system to rear the lobsters. Unfiltered seawater is pumped into the hatchery and then heated to 68°F. The heated seawater is then delivered to a conical-shaped larval rearing tank. The larval tanks are aerated for 48 hours and then the lobsters are removed and placed in another tank of fresh, heated seawater. This technique precludes major problems with water temperature, salinity, pH and dissolved oxygen. The systems need to be replenished every two days because nitrate levels begin to approach saturation. (This technique was used in the Cutler hatchery and is currently being used at the Martha's Vineyard, Galway, Ireland and Shetland, Scotland hatcheries.)

From hatch-out, lobsters are cannibalistic and will freely feed on each other, creating unique culture problems. In the hatchery, predation is controlled and the juveniles are discouraged from cannibalism by being kept separated (through the use of continuous bottom injection of water to keep the lobsters apart in the water column) and by being extremely well fed. (Costs associated with maintaining physical separation and diet requirements, along with the length of time till maturation, have prevented lobster farming from being a viable economic possibility for Massachusetts aquaculture).

Lobsters maintained at 70 degrees all year long take 5 – 7 years to mature. At this temperature, diet demands increase. Further research is necessary to develop an economically viable food source for lobster culture.

Releases of stage IV juvenile larvae typically began in mid-June and concluded in mid-November at Cutler Lobster Hatchery.

Production numbers / costs:

- Martha's Vineyard Lobster Hatchery - produced 500,000 stage IV juvenile lobsters per year at peak production by producing lobster larvae year-round; mid-1990's production decreased to approximately 70,000 stage IV lobsters per year.
- Cutler Hatchery - had a maximum production of approximately 170,000 stage IV lobsters in the late 1980's – early 1990's (Beal, pers. comm).
- Oceanarium Lobster Hatchery - released approximately 32,000 stage IV lobsters at a cost of \$1.97 per lobster in 1992.
- Beals Island Shellfish Hatchery - submitted a proposal in 1994 estimating production of 300,000 stage IV lobsters. This production number is much higher than the Cutler Hatchery ever produced because the facility is larger.

Miscellaneous:

The Gulf of Maine Aquarium does not currently have a lobster hatchery program but it does provide educational outreach regarding lobster biology and research.

The New England Aquarium has a Lobster Rearing Program that is an integral part of the educational program.

Cost Analysis

1991 Cutler Budget

| | |
|--------------------------------|-----------------|
| Administrative Supplies | \$ 200 |
| Hatchery Supplies | \$ 2,300 |
| Utilities | \$ 2,300 |
| Equipment | \$41,050 |
| Labor | \$17,865 |
| Manager (\$7.50/hr) | |
| Asst. manager (\$6.25/hr) | |
| Technician (\$5.00/hr) | |
| Social Security & Workers Comp | |
| Services | \$ 4,040 |
| Other expenses | \$ 1,500 |
| Total | \$69,255 |

Approximately 170,000 stage IV lobsters were released at a cost of \$0.41 each.

Proposed budget for Beals Island Lobster Hatchery (May – August)
(B. Beal – personal communication and based on 1994 DMR proposal)

| | |
|--------------------------------|------------------|
| Administrative Supplies | \$ 500 |
| Hatchery Supplies | \$ 3,220 |
| Utilities | \$ 2,700 |
| Equipment | \$76,000 |
| Labor | \$25,290 |
| Manager (\$15.50/hr) | |
| Asst. manager (\$10/hr) | |
| Technician (\$8/hr) | |
| Social Security & Workers Comp | |
| Services | \$ 4,000 |
| Other expenses | \$ 500 |
| Total | \$112,210 |

Based on previous projections, the Beals Island Hatchery should be able to rear and release 300,000 stage IV larvae. This would be at a projected cost of \$0.37 per lobster released.

*Note – this budget does not include the donation of the building space.

**Committee to Study the Establishment of
Lobster Hatcheries in Maine**

Minutes

September 30, 1999

Department of Marine Resources, Hallowell

Present: Nick Lemieux (Zone A Rep), Gary Genthner (Zone D Rep), Clive Farrin (Zone E Rep), David Wessel (Zone F Rep), Bob Steneck (Darling Marine Center), Rob Horne (Public Member), Rep. David Etnier, Jill Fegley (Sea Grant Fellow), Penn Estabrook (DMR), Laura Taylor (DMR), Terry Stockwell (DMR), Jennifer Smith (DMR).

The meeting convened at 3:09 PM.

Introductions: Nick Lemieux called the meeting to order. Introductions were made around the room for the members that were unable to attend the last meeting. Joining the group was scientist Bob Steneck from the Darling Marine Center.

Review and Approval of the Minutes: N. Lemieux stated that he had quoted a number wrong at the last meeting. Originally, he stated that 300,000 stage four lobsters had been release from the Cutler hatchery, but since the last meeting had found the number should only be 170,000. David Wessel made a motion to accept the minutes with the correction from N. Lemieux. Rob Horne seconded the motion. The minutes were accepted into record.

Why do we want lobster hatcheries? Laura Taylor stated that the last time the Committee had gathered that it had come up with three answers to the question, why? The first reason was biological purposes (egg production), the second was for educational purposes (community outreach and apprentice program) and the third was to stimulate economic activity. She asked if anyone had thought of more to add to this list.

Bob Steneck stated that he would add stock rebuilding under the biological heading. He stated that the egg production goals in the F10 model have specific constraints, and that unless the F10 model is re-written, hatcheries will not add any advantages. He stated that the F10 model is based on the probability of a naturally born lobster reaching maturity and fishing mortalities.

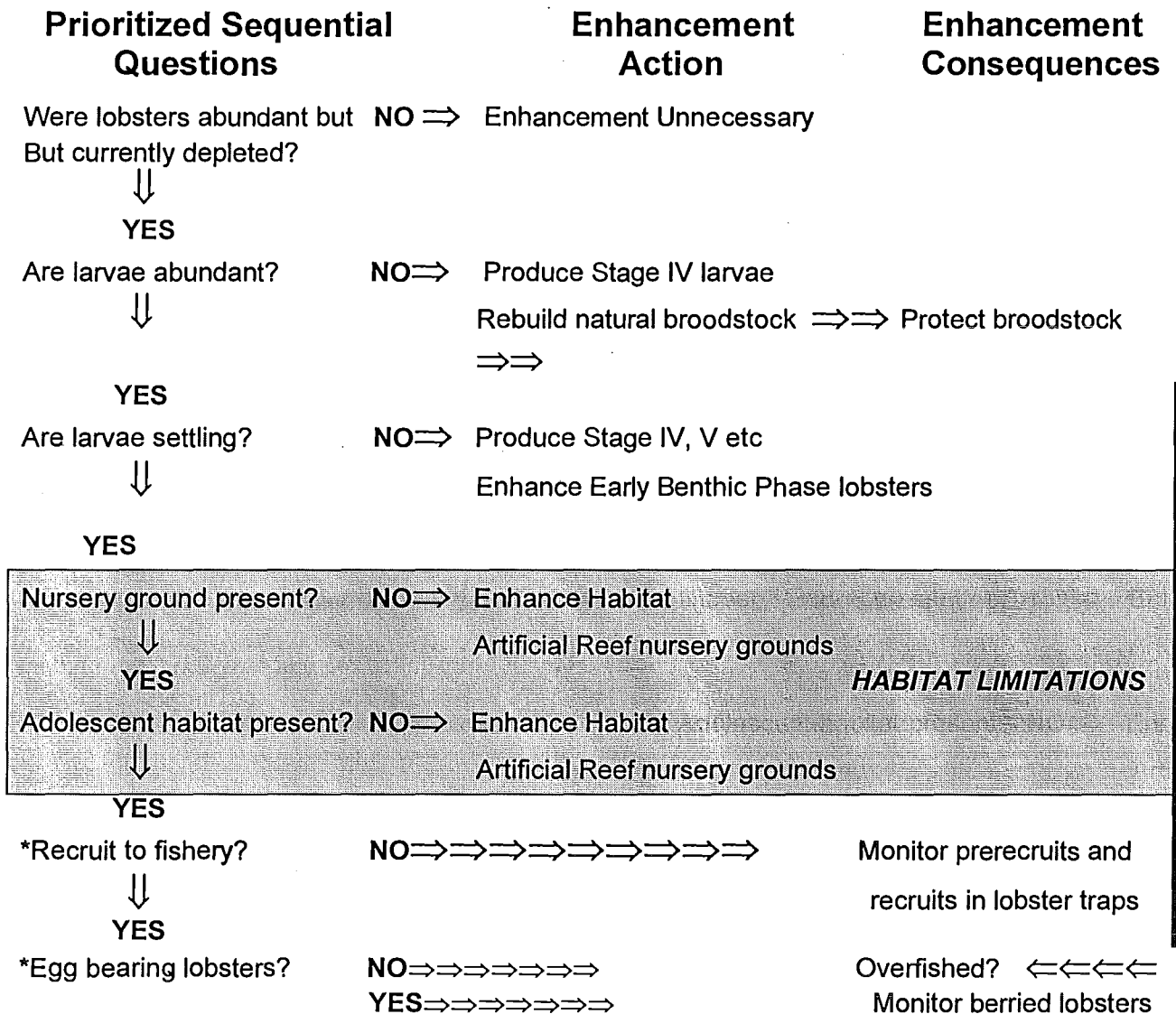
D. Wessel asked if this meant the hatchery would be of absolutely no use to the F10 model because the lobsters were not being born in the wild.

B. Steneck replied that no, the hatchery would not be useful to reaching F10. If you have locally depleted stocks a hatchery could be beneficial to an area for stocking purposes, but it would not be beneficial to egg production in terms of where lobsters are harvested and the proportion of mature female lobsters.

L. Taylor stated that B. Steneck was going to do a presentation that he had recently given in Scotland on the topic of how hatcheries have worked in the US and all over the world. She

stated that he has done extensive research on the different hatcheries in the past, and the hatcheries still in operation today.

B. Steneck began his presentation, "Great Expectations: The Promise and Pitfalls of Enhancing Lobster Stock". He stated that he had come up with the following sequential questions regarding lobster stock enhancement and the consequences for the action:



B. Steneck stated that the promise of stock enhancement is that population bottlenecks could be identified and overcome and the maximum yield from a natural system may be enhanced. The pitfalls were; will it improve the stock? And will it make money?

B. Steneck presented the group with recent hatchery case studies from the US and Canada. The first was a Massachusetts state lobster hatchery that ran from 1949 to 1998, making it the longest run hatchery in the United States. B. Steneck stated that during its most successful

year, the hatchery released 500,000 stage IV post larvae. The facility had two full time and four part time operators with combined salaries of almost \$100,000 per year. The annual operating costs for the facility were unsure, and this hatchery never had any evidence of success. In 1998 the state of Massachusetts halted the operation of the hatchery, and today it is a basic research facility.

The next case study was a community-based public stock enhancement program in Cutler, Maine. This hatchery release 175,000 stage IV and V lobsters from 1986 to 1991. It had an annual operating cost of \$25,000 to \$30,000. In 1990 1,500 stage IV blue lobster were released in the Cutler area. By August of 1999, 40 blue lobsters were reported being caught by local fishermen, a 2.7% survival to recruitment size. This gives a \$10,000 to \$20,000 annual value of the hatchery-released recruits (a net loss).

David Etnier asked if the 2.7% survival to recruitment comes from only the blue lobsters released and if the lobsters were tagged or just blue in color. B. Steneck replied that yes, the number came from just the blue lobsters recovered, and that the blue lobster were not tagged.

B. Steneck presented the Committee with highlights from a report on hatcheries done by Waddy and Aiken in 1998. The report stated that the requirements for a lobster enhancement facility were high quality seawater (if recirculated water is used it must be maintained at high quality standards), duplicated and backups for all critical systems such as pumps, electrical supply and heat, and personnel must be well trained and diligent about following strict protocols. The report stated that the annual landings from the Magdalen Islands in Canada are 1800 tons. To enhance the stocks in that area by 10% would require 4,000 egg-bearing female lobsters, 16,000,000 stage I larvae (4,000 – 8,000, 40 litre larval rearing chambers), and 4,000,000 stage IV post larvae being released into the area. These numbers would produce 400,000 recruits to the fishery assuming a 10% survival and complete retention to the recruitment.

Jill Fagley asked if a 25% survival from stage one to four is accurate. B. Steneck stated that yes it was. He said that in some cases it can go down to 15% and in some go up to 75%. He added that if disease can be kept down the numbers could stay on the higher end.

B. Steneck continued his presentation citing case studies that have been done in Europe. He stated that in 1993 Ireland had no lobster fishery management at all, but has gone on to be the country to put the most gross national product into hatcheries than anyone. In Ireland the output and percent survival of hatchery reared larvae from 1993 to 1996 were as follows: Survival of stage I to IV was 40%; Survival of stage IV to V was 50%; and the number of recaptures is still unknown. In 1993 they released 32,000 stage IV, in 1994 132,000 stage IV, in 1995 45,000 stage V, and in 1996 45,000 stage V. B. Steneck stated that in Ireland they wanted to improve the chances of survival for the lobsters once they were release so they raised lobsters in the hatchery until stage V instead of IV. He added that the lobster landing in the area of Matinicus Island exceed all of the lobsters landed in the U.K., stocks are very low compared to Maine.

The next case study was from Orkney, Scotland. The output and percent of survival of hatchery reared larvae form 1994 to 1999 was as follows: Survival of stage I to VIII larvae was 13%; recaptures were unknown but assumes to be 4% to 5%; the full time salary for someone to run the hatchery is only 15,000/year; and the price per pound is high at \$5 - \$10 per pound. Releases from the Orkney hatchery were 400 stage IV lobster in 1994, 5,500 stage IV lobsters in 1995, 12,000 stage IV lobsters in 1996, 11,500 stage VIII lobsters in 1997, 30,000 stage VIII lobsters in 1998, and 50,000 stage VIII lobsters in 1999.

B. Steneck stated that in the next case study done in England, Wales and Scotland that all lobsters were kept in the hatchery until they were large enough to tag, this ensuring a better chance of the lobsters staying in the area. The releases occurred from 1983 to 1990 and the recapture data is from 1985 to 1994. In Bridlington, East England of the 49,128 tagged lobsters that were release 0.5 to 2.5% were recaptured; in Aberystwyth, Wales of the 19,233 tagged lobsters that were release 1.2 to 5.0% were recaptured; in Ardtoe, West Scotland of the 3,044 tagged lobsters that were released 0 to 5.5% were recaptured; and in Scapa Flow, North Scotland of the 19,520 tagged lobsters released 0 to 4.8% were recaptured. B. Steneck stated that the 2 to 5% recapture statistic is the most realistic.

D. Etnier asked how large the released lobsters had been. B. Steneck replied that the lobsters were the size of an average two-year-old Maine lobster, but had been accelerated to that size in about three months.

B. Steneck stated that in a hatchery in France a reported 225,000 stage IV lobsters were released with a recapture rate of only 0.09%.

In Norway 125,732 8 to 20 month old, hatchery reared, microwire-tagged lobsters were released. The recapture rates of the lobsters in 1996 were 6 to 7%. 40% of all lobsters landed in the area were tagged, but this was because the lobster stocks had crashed. The catch rates today in that area remain very low.

B. Steneck stated his conclusion of the fate of hatchery-reared lobsters:

| <u>LIFE HISTORY STAGE</u> | <u>SURVIVAL (Concerns)</u> |
|---|--|
| Egg bearing lobster Hatching | Handling losses (deplete wild stocks) |
| Stage I Larvae to Stage IV post larvae | 3 to 50% survival |
| Transportation mortality | 95% survival |
| Release | |
| 1-month | High survival |
| 1 to 2 years | 10% recovered |
| Recruitment to the fishery | 0 to 7% (Average is less than 3%) |
| Reproduction | Have succeeded but % survival is unknown |

B. Steneck finished with a quote taken from the 1999 Bannister presentation *Summary of Economic Prospect for European Enhancement*. "Estimating cost of production, allowing for economies of scale, there must be 50% recovery of released lobsters for a hatchery to break even. That is about ten times greater recapture percentage than has ever been documented or suggested."

B. Steneck told the Committee that he came up with some estimates on the cost per effort of the Cutler hatchery in Maine. If the hatchery produces 300,000 stage IV lobsters with a 5% recovery, that translates to 15,000 lobsters at 1¼ pounds at \$3.50 per pound gives \$65,000 of income to the fishery, but at an expense of \$100,000 to the hatchery. He stated that these numbers were very optimistic. He suggested that the Committee look at the fact that 90% of all hatcheries have been closed because it has never been demonstrated that they work. He stated that if a hatchery is wanted it should be put in an area that is completely depleted so that it will be known if it makes a difference in three to four years. He added that billions of larvae would be needed to have a geographical impact on just a bay or a cove.

Penn Estabrook asked if there was a recruitment problem that should be addressed with hatcheries.

B. Steneck stated that a decline in recruitment has been in York, but that was coming back up. Boothbay Harbor's recruitment was increasing for the first time in a decade, and increases are being shown in recruitment everywhere else. There is a new ASMFC report that says they are detecting an increase in the brood stock in the Gulf of Maine and that there are some interesting trends in recruitment for the area. Colin Bannister reported that although enhancement is possible with hatcheries, management is the best policy.

T. Stockwell asked if a hatchery would help benefit the scientific community. B. Steneck stated that given all of the information that research would be the best reason to invest in hatcheries before going any further. He stated that a research facility with controlled release sight to test any impacts and at what scale would be the best ideas.

T. Stockwell asked what the research cost would be for a hatchery. B. Steneck stated that it depends on many factors. He stated that the cheapest alternative is to have the local fishermen volunteer their time with a hatchery facility. He stated that results in a controlled release sight area would be starting to show in three to four years.

N. Lemieux stated that he originally believed hatcheries to be a viable operation, but after hearing the report from B. Steneck he now has some mixed feeling. He stated that given that, he still thinks hatcheries would help because they would be putting more lobsters into the water. He stated that there are many numbers out today relating to the F10 model showing the number of lobsters supposedly in the waters, but that still does not guarantee that he is going to catch any. He stated that he agrees management is the best key, but additional manners, such as hatcheries would also be beneficial.

B. Steneck stated that this could possibly be a "if it is not broken, don't fix it" scenario. He stated that he has been speaking with many fishermen and they are reporting seeing more shorts and eggings than they have in many years. He stated that the lobster fishery in Maine is a healthy fishery, and a hatchery couldn't make a dent in the number of lobsters already being caught. He stated that the Committee needed to look at the cost versus benefits.

D. Wessel asked if a hatchery could ever cause over population of the fishery. B. Steneck stated that some people do think density dependent control could add to mortality. He stated that right now scientists are seeing one to two lobsters per square meter on the bottom. He stated that four lobsters per square meter would be over populated. If a hatchery released too many lobsters in to one area, then all of the lobsters would have to move to keep from dying.

P. Estabrook stated that hatcheries seem to make sense when you have absolutely zero stock (i.e.: shad), but that those fisheries are not comparable to the lobster industry.

C. Farrin stated that a hatchery should be started to at least help depleted stock areas. B. Steneck asked if any of the Committee members knew of an area in Maine that was totally depleted of lobster stocks. C. Farrin stated that he could not think of any and that maybe a hatchery wasn't needed. P. Estabrook stated that a hatchery could still be viable for educational purposes.

N. Lemieux stated that an ideal scenario would be to find out if stage IV lobsters will make it to legal size. He stated that research in a natural environment along the coast (i.e., a small cove) is needed. B. Steneck stated that stocking a small area could cause over population in some areas and not others. He stated that if you invest in a hatchery you must invest in science at some point. J. Fagley asked how many lobsters would be needed to see some results in a small cove. B. Steneck stated that if you placed 300,000 lobsters in an area you could possibly see some modest results in a minimum of three years.

B. Steneck stated that he does not recommend the Committee ask for money to establish hatcheries. B. Steneck told the Committee to ask themselves what the best reason for a hatchery would be – educational, biological, to recover completely depleted area?

C. Farrin stated that he did not believe a hatchery was feasible for every zone, but maybe in one zone if only for educational value.

Robert Horne made a motion that based on the legislative charge the we are here for, the Committee should write a report stating that the feasibility of hatcheries in every zone is not there, but continued industry support for existing hatcheries should be continued.

D. Wessel seconded the motion.

B. Steneck stated that the Committee should consider focusing on the points that have yet to be addressed and reconvene to see if anyone else comes up with more recommendations.

R. Horne withdrew his motion.

B. Steneck made a motion to complete the final report that covers all of Legislature's charges/duties.

R. Horne seconded the motion.

C. Farrin stated that he believed the Committee should go a step further then the legislature asked for and outline the support for continued funds to existing hatcheries for educational and research purposes. He stated that the Committee had a specific charge from the legislature, but there is no reason it cannot add to the report more recommendations.

B. Steneck stated that if the Committee can't agree that one hatchery is viable then it should wonder if supporting a research hatchery is worth it. He stated that he did not see an economic gain from a hatchery program. B. Steneck stated that more is not always better, and if money were spent it would not guarantee seeing any benefit for the effort. He stated that the Committee should be sure to include what it does know and what it does not know about hatcheries. He added that if there is a crisis in the lobster industry in the future that some day

this may be looked into further, but he does not see any need for a research hatchery at this time.

T. Stockwell asked if the Committee still wanted to support a surcharge on licenses to support the educational purposes of a hatchery. D. Wessel stated that he believed it was necessary to still support ongoing hatcheries for educational purposes. B. Steneck withdrew his motion.

R. Horne re-submitted his motion that based on the legislative charge the we are here for, the Committee should write a report stating that the feasibility of hatcheries in every zone is not there, but continued industry support for existing hatcheries should be continued.

D. Wessel seconded the motion.

The Committee members voted for the motion was unanimous decision.

The Committee scheduled the next meeting to review the draft report for December 16, 1999 in at the Department of Marine Resources in Hallowell.

The meeting adjourned at 5:42 p.m.

**Committee to Study the Establishment of
Lobster Hatcheries in Maine**

Minutes

**December 16, 1999
Department of Marine Resources, Hallowell**

Present: Nick Lemieux (Zone A Rep), Steven Robbins III (Zone C Rep.), Gary Genthner (Zone D Rep), David Wessel (Zone F Rep), Bob Steneck (Darling Marine Center), Rob Horne (Public Member), Penn Estabrook (DMR Rep.), Jill Fegley (Sea Grant Fellow), Laura Taylor (DMR), Rep. Martha Bagley (District 133), Norbert Lemieux (Zone A), Leroy Bridges (Zone C), Bob Brown (ME Import/Export Lobster Dealers Assoc.), Teresa Montague (MDI Oceanarium).

Review and Approval of Minutes (9/30/99): Nick Lemieux questioned the number of blue lobsters released in Cutler in 1990 as stated in the minutes. Bob Steneck replied that he used figures from a publication by Brian Beal and discussions with Bob Bayer at UMO. Teresa Montague stated that she released lobsters with Brian Beal and they released 1500 lobsters, not all were blue. She questioned the use of the word "survival" on page 3, paragraph 1. B. Steneck replied that there have been 40 blue lobsters documented as captured and many of these could be the same lobster captured twice.

Stevie Robbins had questions about the 500,000 figure of released lobsters from Massachusetts (page 2). B. Steneck clarified that this was the most released in a single year. The notes were changed to more accurately reflect this. S. Robbins also expressed concerns about how the lobsters were released in Massachusetts and how that may affect the results. He pointed out all the lessons learned at the Cutler hatchery over the years. Norbert Lemieux stated that the Cutler hatchery was successful in raising stage IV lobsters.

A discussion occurred about how many eggs survive in a clutch.

Teresa Montague asked to read a statement she had prepared. The statement is attached.

Bob Brown expressed concern that the hatcheries will result in the federal government wanting more control in Maine.

Penn Estabrook made a motion to accept the minutes. Bob Steneck seconded the motion. The minutes were accepted into record.

Discussion: Nick Lemieux stated that maybe there is still a way to help the lobster fishery with hatcheries. He felt the first hatchery meeting was productive, but the second meeting was stacked against hatcheries. B. Steneck clarified that during the last meeting he did not give an opinion about hatcheries, he was asked to research other hatcheries and report back to the Committee. He presented what he had found in the literature about hatcheries. Nick Lemieux stated that the Maine lobstermen did the vent, 5 inch, v-notch and seed lobsters and that all went through because of the fishermen. Some of the fishermen feel hatcheries are another way

to make a contribution to the resource. Penn Estabrook stated that Bob Steneck has objectively reported the information he found and Nick Lemieux had done an excellent job expressing the fishermen's viewpoint. He suggested the Committee review the charge from the Legislature and be sure the report covers the suggestions made about researching the effectiveness of hatcheries in stock enhancement. B. Steneck agreed and stated that he would like to see any research be cooperative with the fishermen. Norbert Lemieux stated that he is not against other management measures, but would like to see hatcheries as an option. He said the lobster fishermen are willing to fund a hatchery out of their own pockets and are not asking for general fund money. He knows that hatcheries can't be set up in all seven zones, but suggested setting up three in the first year. He stated that he knows hatcheries won't make the biggest difference, but they will help. B. Steneck suggested that you need to see a pattern of increase stock abundance to see if hatcheries will actually help. There was a debate about the effectiveness of the Cutler hatchery.

S. Robbins asked David Wessel what the lobstermen in the south think about hatcheries. David Wessel replied that they are seeing a lot of v-notch and juveniles and are concerned if hatcheries are feasible. He didn't think there would be a lot of support for hatcheries because you would be leaving even more lobsters on the bottom. He would, however, feel more comfortable knowing there was a hatchery that could produce lobster in a crisis. B. Steneck suggested that hatcheries in a crisis may be helpful, but he still believed he would rather put his money in a bank than into a hatchery.

Leroy Bridges suggested that you would need money for the hatchery and money to do research on the effects of a hatchery on the population. It was noted that lobsters can be tagged now to help see where they go.

The Committee reviewed the draft report and made changes to the four recommendations. Rob Horne made a motion to accept the report as amended. Stevie Robbins III seconded the motion. The Committee unanimously accepted the report as amended.

Note: These draft minutes are included in the final report without review by the Committee.

Resource Management is essential in any industry and for any resource. Monitoring of population densities, dynamics, distribution, health, habitat capacity, changing environmental conditions etc should be continuously monitored.

Management of existing resources does not exclude enhancement.

Good management includes research. **The time to do research is not after you are in crisis. The time to do research is when you have questions and want answers.**

MICELLANEOUS STATEMENTS

The Cutler and Darling Research Center hatcheries are both designed by Brian Beal and Sam Chapman. The Bar Harbor facility has modified those systems and currently operates differently than its predecessors.

Hatcheries do not usually breed lobsters they rear young although it may be to someones advantage to consider breeding and raising red lobsters. They grow twice as fast as the regular lobster and are already a pretty red marketable color unlike the blue which also grows twice as fast as the regular lobster but has less marketing appeal.

Refrigerating larval lobsters retards their growth defeating the purpose of a growth rate that is 3 or 4 times as fast as the ocean's. It would mean more maintenance with fewer lobsters released. ie time=\$. Refrigeration is a great way to hold and suspend lobsters but is adverse to growing them.

Lobsters can handle a shock variance in temperature of 10 degrees celcius. Slowly equalizing lobsters temps to similar temperatures in the release environment would be suggested. During current culturing processes the water used to grow the lobsters is not that much above the natural environment so releases do not usually have to be acclimated.

Rick Wahle, Mt. Desert Oceanarium, and the U.of RI., as well as some European hatcheries can tag lobsters with microwires.

I have consistently tank tested Stage 4 lobsters before releasing them into the natural environment to make sure they will settle when released. They usually settle and hide after a few minutes. They expose themselves and hunt for food, then drag the food back to a sheltered place to eat. Often they move into a shell or cranny and defecate it too.

If lobsters fight they tend to try to develop a dominance chemo memory and when they smell the same lobster they recognize it and usually don't have to fight again. There are times when a battle to redetermine or initially establish dominance does become fatal.

Possible USDA grants may be available for hatcheries if they are run as a private business or from private orgs.

The biological process of a hatchery is not in egg production but rather greatly enhanced survival of post larvae to a releasable size.

500,000 stage 4's is questionable for the Mass Hatchery. Stories vary greatly but it is said the "State declined to fund it because"...."they lied about the #'s", "They could not prove effectiveness", and my all time personal favorite... a quote I got this year from a Martha's Vinyard Shellfish Hatchery employee when I asked them directly why no hatchery?.. "our director just chose to go in a different direction".

The 2.7% recovery rate for blue lobsters does in no way indicate the true survival rate of the 1500 released. It is only a recovery rate. There are many reasons lobsters may not have been caught. Some lobsters just don't trap say scientists. some may have moved to another location. Some may yet be trapped.

I think it is hard to compare the UK. to the US, because of the difference in habitat. If I am not mistaken Main has much more rocky bottom than does the UK and it has the Bay of Fundy and all the awesome estuary and tidal action feeding our coastline making it nutrient rich and productive. Their stocks may be much lower than ours in part due to less habitat for rearing juveniles.

Brian Beal, PHD visited Ireland in the late 90's and since consulting with their hatcheries and introducing Cutlers culturing processes, their survival is claimed to have gone from an average of 10% to 80%. Very significant infor given no attention.

When keeping stage 4's in condos to stage 5 and beyond I had very little mortality and it was easier to maintain than expected.

Release and Recovery data from ENG., Wales, and Scotland start in 1983 with releases and in 1985 with recapture. These animals in 2 years growth would not be expected to be caught in normal traps. So how was the data collected? Even though it spanned several years they were doing releases up until 4 years prior to the last recovery data but many of the lobsters released may yet be out there.

The scientific evidence only shows how many have been caught but alot depends on how many and when the lobsters were released as well as just the total currently caught.

In France how were the 225,000 tagged and collected?

In Norway when were they released and over how much time? Recapture in 1996 of how many and what stage? If indeed 40% of the lobsters caught in the area were tagged, a substantial indication that hatchery lobsters do survive. Catches were still low so I believe it was not to that industries advantage to harvest those lobsters. They should have been returned to the environment to reproduce. Or more study is needed to be done on the capacity of that environment to support lobster populations.

Mount Desert Oceanarium gets almost no drop off form gravid mom's and well into the upper 90%'s for hatch off rates.

In the past three years we have had mortality on an average of 1 mother lobster per year. This may represent 1% of the females that are used in a year at the hatchery. Mortality causes were unknown. Too much stress in handling? One was lost when it did not shed properly. But all in all most of the mothers arrive and leave vigorous.

I think recruitment figures of hatchery lobsters is fairly inconclusive. Not enough data. More research needs to be done.

Lack of demonstration that hatcheries work does not necessarily mean they don't work. Lack of adequate scientific data may be why they appear not to work.

Only lobsters that are tagged in a way to show hatchery rearing can ultimately be used to prove hatchery recovery. Only genetic tagging will let us know which of the hatchery lobsters are reproducing and enhancing the population that way.

Management is the best policy for our resources but even if say forestry per se were to look for sustainability it needs to look at it's stocking practices as well as it's harvesting practices. I believe hatcheries could be an intergral part of a sustainable lobster fishing industry.

Global warming due to natural cycles or pollution could be a factor in more recent recruitment since this species is so temperature dependent for growth, reproduction, and habitat constraints. If warming continues lobsters metabolisms like salmon could theoretically get so fast they can not eat enough even if food is available. They just won't be able to eat enough

and they may starve and die out or move to a completely new region.

Lobsters seem to space themselves out. Especially when newly stocked. They keep moving till they get the space they need. If a population were contained only in the area released and crowded food supplies would diminish and the population would crash. But I believe after having watched tank and underwater releases that they would spread out and cover more territory than starve or be too crowded. Again resource management needs to monitor densities because not all areas have the same niches or capacity.

If only one hatchery is needed for educational purposes then the existing hatchery at Bar Harbor already fits the bill. It has a very good tour developed for the public and school groups. It is in a high tourist area that serves millions of people from all over the world.

It may be advantageous to have hatcheries in more southwest location for education ie Boothbay Harbor or the new Portland facility if stocking is not it's primary function. However, juvenile lobsters travel fairly well and could be transported anywhere in the state for stocking.

Apparently it is not yet truly determinable what the effect a hatchery is having. Most studies here are small in nature and have been hard to quantify. MORE RESEARCH! on the impact of hatchery releases needs to be done.

It takes research and the ability to repeat the same process with similar results to confirm or not the benefits of any scientific endeavor.

It is a shame that only figures from Cutler are used to estimate the cost and effectiveness of hatcheries here in Maine when Stonnington and Mount Desert Oceanarium should also have data to contribute.

I believe when these hatcheries were licensed by the DMR as a condition of the license they agreed to make their books and other collected data available to the DMR.

As far as I can tell there is no way to know if the seed lobster program or the V notch program is having a positive effect on the lobster population. Yet no one seems to say it has to prove itself to continue.

The only real known benefit of the seed program is to the pound owner who is basically being subsidized for it's lost investment due to the development of eggs externally. This is in itself not a bad concept.

Cost of Hatcheries exaggerated. Steneck uses a total of 175,000 lobsters released over many years at Cutler to determine the cost of a hatchery but does not acknowledge that the production rate was almost that for just one year during the latter years the Cutler hatchery was open.

A more current production rate needs to be used to estimate hatchery costs. Indeed to revise the numbers in the minutes it should be said that the Cutler hatchery can produce approx. 150,000 stage4's per year and that the cost of raising them is about \$30,000 per year not \$100,000. If the same 5% recovery rate used in the minutes is used here then the sum of recovered lobsters might be 7,500 (1.25 lb.lobsters) @ \$3.50 per pound. Equaling the the sum of 32,812.5. **Indeed this would represent a profit** although it be small of \$2,812.

There are still untold benefits of lobsters from the hatchery yet to be caught or those added to the population who reproduce themselves and enhance the population that way.

Hatcheries can be staffed in many ways. It is a great learning experience for interns who may be paid in part by work study programs through the U of ME.to cut costs. But there are disadvantages to constantly changing and having to train staff.

Accidents happen. If instructions are not followed a survival rate for a batch can be less by far than the low 1/10 of 1% in the natural environment. Ex. I had a retired biology professor fill in for a few weeks at the end of a season after the student interns had returned to their fall semesters. He started a batch of lobsters at the same temp used for starting brine shrimp and cooked about all but 30 of the stage 1 lobsters that were in that tank. I salvaged 30 live animals and added them to another tank but it is not very probable that they continued to survive.

Time is money we have all heard and it is time consuming to constantly explain and direct others to do new and unfamiliar work. Much less time and labor cost would be used ultimately if a hatchery had a well trained staff familiar with the concepts and

working procedures of the hatchery and it's history and idiosyncrasies

The seasonality of a hatchery makes it difficult to get staff to return year after year and much is lost in experience each time a newcommer takes over and tries to step into someone elses shoes.

Salaries for managers should be substantial enough to help sustain them through the winter months so that they can return to the hatchery and continue to keep a thread of consistency in hatchery operations and in the unique relationship hatcheries have with their lobster fishing and release partners.

Why hatcheries? Stock enhancement, education, sustainable fishing practices, and research.

There has been considerable data collected that indicates thermal currents or layers inhibit lobster recruitment into the Down East coastline north of the Penobscot Bay. It is also speculated that the coves in this area of the coast are good habitat for lobsters. It is speculated that these areas have a capacity to have more lobsters than they do. This is a good reason to target an area for enhancement.

More research needs to be done to determine just what areas need and can support a larger lobster population.

During some of the years I lived in Washington Co. it had the highest unemployment rate (UR) in the nation as well as the highest rates for: wife abuse, child abuse, incest, teenage pregnancy, alcoholism, and divorce in the nation. Most of those depressing categories can come under the heading of unemployment.

Suicide rates for teens in rural Me. areas is also up and lack faith in a prosperous future is part of that scenario.

We will be turning our backs on our neighbors and our children if we do not try to figure out how to enrich and enhance our natural resources and economy in this area. And this applies to land as well as sea.

Do hatchery lobsters survive in the natural environment? Studies done by Wahle say they do and that they tend to stay within their released area for maybe 2 to 3 years. The study with blues in Cutler 1990 is an indication that they survive. The study being done in RI. Narragansett Bay has indicated lobsters reared in the Bar Harbor hatchery and tagged with micro wires at the U of RI. are surviving in an artificial reef in that Bay. Studies in

Scotland show tagged hatchery released lobsters have grown to be reproductive adults in the wild.

Another reason why hatcheries are important. The research being done in RI and assisted by Rick Wahle of the Bigelow Lab is funded by an oil company trying to repair the fishing industry after a bad oil spill. Nice to know hatcheries can be bandaids or first aid to bad situations. The RI facility could not be doing the project it is undertaking now if the Bar Harbor hatchery did not supply the substantial numbers of juvenile lobsters (2,000 stage 4's per season for the last two years) needed to do the study.

The RI folks put together a hatchery but were not successful in raising the needed amount for their study. At present the Bar Harbor facility is the only hatchery operating in the US or Canada, with the exception of a small one for display purposes at the New England Aquarium. Thus it was the only hatchery able to assist it's distant neighbors with a sizeable amount of animals to meet their research requirements in their time of need. Results from their study will also be enlightening to Maine as well.

Again. A well established, consistently productive hatchery system is a treasure and a resource this state, country, and industry should support. For enhancement, for education, and for research.

Proof There are lots of things we still don't know about lobsters that a hatchery with a tagging system could help to discover. If a hatchery were to tag tens of thousands of lobsters and release them over a span of say ten years, an incredible data base for future research could be developed. Lobsters could be tagged by the year they were released or by the batch using micro wires or other tagging methods. Accurate data of amounts released, release times, and GPS logs of locations kept by the hatchery would provide a future database for scientists for many years to come.

From such a base research on the age of lobsters, migratory patterns, hatchery survival or recovery rates, disease...etc could all be done from the same data base.

In order to find out if hatchery lobsters are reproducing and contributing young and how many to the population, lobsters would have to be genetically tagged. Recovery of that data would be expensive I believe, as well as difficult. But without genetic tagging, none of the stocking efforts to enhance the natural population through reproduction by released hatchery reared lobsters or seed lobsters or V-notches are quantifiable.

APPROVED

CHAPTER

MAY 11 '99

21

BY GOVERNOR

RESOLVES

STATE OF MAINE

IN THE YEAR OF OUR LORD
NINETEEN HUNDRED AND NINETY-NINE

H.P. 636 - L.D. 886

Resolve, to Study Lobster Hatcheries

Emergency preamble. Whereas, Acts and resolves of the Legislature do not become effective until 90 days after adjournment unless enacted as emergencies; and

Whereas, it is a goal of the State to enhance the lobster population and ensure a sustainable lobster fishery; and

Whereas, it is in the interest of the State to study the feasibility and cost of establishing lobster hatcheries; and

Whereas, a study must be initiated promptly in order that the study may be completed and a report submitted in time for the next legislative session; and

Whereas, in the judgment of the Legislature, these facts create an emergency within the meaning of the Constitution of Maine and require the following legislation as immediately necessary for the preservation of the public peace, health and safety; now, therefore, be it

Sec. 1. Committee established. Resolved: That the Committee to Study the Establishment of Lobster Hatcheries, referred to in this resolve as the "committee," is established; and be it further

Sec. 2. Membership; appointments; chair. Resolved: That the committee consists of 10 members appointed as follows:

1. Seven members representing each of the lobster management zones established under the Maine Revised Statutes, Title 12, section 6446, appointed by the lobster management policy council established for the zone;

2. One member representing the Department of Marine Resources;

3. One scientist, appointed by the Commissioner of Marine Resources. The commissioner shall consider recommendations made by the Lobster Advisory Council; and

4. One public member, appointed by the Commissioner of Marine Resources.

All appointments must be made no later than 30 days following the effective date of this resolve. The committee shall select a chair at its first meeting; and be it further

Sec. 3. Meetings. Resolved: That the Commissioner of Marine Resources shall call and convene the first meeting of the committee no later than June 15, 1999. The committee shall notify the members of the Joint Standing Committee on Marine Resources of each meeting; and be it further

Sec. 4. Duties. Resolved: That the committee shall gather available data and studies relating to lobster hatcheries and examine the feasibility and cost of establishing lobster hatcheries in the State. The committee shall submit a report in accordance with section 7; and be it further

Sec. 5. Staff assistance. Resolved: That the Department of Marine Resources shall provide necessary staffing services to the committee; and be it further

Sec. 6. Compensation. Resolved: That the committee members serve on a voluntary basis; and be it further

Sec. 7. Report. Resolved: That the committee shall submit a report with its findings and recommendations to the Joint Standing Committee on Marine Resources by December 31, 1999. The recommendations must include provisions for hatcheries to produce Stage IV lobsters for the entire coast and for the establishment of up to one hatchery per zone; and be it further

Sec. 8. Legislation. Resolved: That the Joint Standing Committee on Marine Resources may report out legislation during the Second Regular Session of the 119th Legislature regarding lobster hatcheries.

Emergency clause. In view of the emergency cited in the preamble, this resolve takes effect when approved.