South Carolina Shellfish Management Plan

July 2005

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Ocean and Coastal
Resource Management

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1.0 Executive Summary

The Eastern oyster, *Crassostrea virginica*, and the hard clam, *Mercenaria mercenaria*, are relatively abundant in coastal waters, but comparisons with historical surveys reveal that these resources have been heavily harvested in certain areas of the state. Environmental alterations, human activities that impact reefs, and a major industry change from a cannery-based to a predominately shellstock system have influenced the resource and changed harvesting pressures. Fishery-dependent data were analyzed to determine if trends in harvesting pressures were visible. Harvest has remained relatively stable for the past ten years; however, more active management practices may be necessary to sustain the resource as regional population, development and resource demands grow.

Comparison of management practices in South Carolina with those of other South Atlantic and Gulf states shows that states take various approaches to shellfish resource management. Bottom leasing is common, but the fee structure and the application process for new leases vary between states. Atlantic states have use and/or planting requirements on leases, while Gulf states, for the most part, do not. Regulations for handling harvest on public beds and ownership of shell after harvest also vary from state to state. Most states try to use state equipment to plant public grounds using federal funds, grants, license fees, or state appropriations. Regulations used in other states were considered for South Carolina management.

Interviews were conducted with management staff and industry members to determine program success and future expectations, as well as to gather ideas for new management techniques. Staff and industry members agreed on a number of issues and were overall satisfied with the present system even though they saw areas that could use improvement. A number of recommendations for future management goals were compiled from these suggestions and review of approaches by other states. These suggestions included changes in departmental coordination, replanting efforts, culture permit management, state shellfish ground (SSG) management, and department/industry interactions.

2.0 Introduction

The two molluscan shellfish species of economic importance in South Carolina are the eastern oyster, *Crassostrea virginica*, and the hard clam, *Mercenaria mercenaria*. The eastern oyster is a keystone species in the estuary. It is well adapted to changes in salinity, temperature, turbidity, and dissolved oxygen and provides food and habitat to numerous marine species. In addition, oyster beds stabilize and protect the shoreline from erosion and lower turbidity in the water column as the oysters feed. Oysters in South Carolina are unique in that nearly 95% of beds are intertidal. Due to prolonged spawning and successive attachment of new generations, oysters grow in clustered reefs. As a result, oysters grow in naturally occurring beds along the intertidal portions of the marsh. The economic importance of the oyster is well documented along the Atlantic Coast and in South Carolina; oysters were the most valuable fishery until exceeded by shrimp trawling in the mid-20th century.

The hard clam is harvested in the wild in South Carolina, but as a fishery its importance comes from the species being farmed by mariculture. Mariculture is defined in South Carolina as "controlled cultivation in confinement" and currently is entirely hard clam (*Mercenaria mercenaria*) mariculture using soft mesh bags and "bottom plants" (mesh screening) placed on bottoms. Unlike the more highly adaptable oyster, hard clams require a relatively high salinity in order to live and reproduce. In South Carolina clams grow in both intertidal and subtidal areas, burrowing into a variety of substrates including sand, mud, and shell. Clams maintain mobility throughout their lives and move both vertically and horizontally in the substrate. In South Carolina, wild clams grow to a marketable size (about 2 inches in length) in 3 to 4 years. Maricultured clams usually grow faster and are sold either at marketable size or as seed clams to be grown out in other states for marketing.

2.1 Issues and Concerns

Although shellfish are relatively abundant along the South Carolina coastline, comparisons between recent and historical surveys and fishery-dependent data suggest that the resource is heavily harvested in certain recently-legislated common property

areas. Increased pressure has been placed on the shellfish resource by environmental alterations and water degradation, physical disturbance, and lack of shell for replanting, and changes in the industry and harvesting demands. South Carolina's predominantly intertidal shellfish resource and, in particular, subtidal oyster beds, have been diminished over the years due to salinity regime changes: Atlantic Intracoastal Waterway construction, Cooper/Wando/Santee River rediversions, accelerated freshwater inflow into estuaries by wetland drainage projects, and the clearing of land for forestry and agricultural purposes.

Human activities that negatively impact oyster reefs directly are recreational boating (especially in small tidal creeks where boat wake impacts are more forceful), construction of docks and marinas, and improper harvesting of shellfish. Environmental perturbations such as rediversions of rivers, rapid runoff from impervious surfaces and dredging operations also greatly impact the resource when present. Since South Carolina oyster reefs are vertical clusters built on an underlying matrix, physically impacting this structure can disrupt the reef. During harvest, clusters are broken into smaller groups that can be dislodged by waves and boat wakes, and the shell matrix is altered by the harvest of the oysters. Husbandry and cultivation of high-density reef areas, however, is beneficial for growth and propagation. A sustainable level of harvesting reduces the population density, allowing oysters to grow larger. Replanting of oyster shell on beds is necessary to keep the reefs viable by providing needed substrate for spat settlement. In South Carolina oysters spawn from May to October, and free-swimming larvae are carried by the tide and currents for two to three weeks before settling to the bottom and attaching to suitable substrate, preferably oyster shell. Newly attached oysters are commonly referred to as "spat". Larvae that do not find a hard substrate for attachment or those who attach in unsuitable locations soon die. Passive management relies on natural recruitment and cultivation (e.g. shell re-planting) by industry members. However, not all beds are cultivated; specifically, little or no cultivation is applied to SSGs. A shortage of shell for replanting and the lack of funds for staff and equipment have severely limited the scope of shell replanting by the state.

Another major concern to shellfish managers is the significant change that has occurred in South Carolina's industry since the mid 1980s. The modern oyster industry in South Carolina began in the late 19th century with commercial production peaking shortly after the beginning of the 20th century. Due to bed closings from pollution and labor shortages, production fell, eventually leading to a decline in the commercial oyster canning and shucking businesses. These canneries, the last of which closed in 1986, produced a continuous supply of oyster shell for replanting in their lease areas. Today,

most oysters are consumed at restaurants or backyard oyster roasts, and leftover shell is often used for driveways or discarded. To increase the amount of oyster shell available for replanting, the South Carolina Department of Natural Resources (SCDNR) instituted a shell recycling program. However, lack of staff, equipment and funding continue to be problems that limit its widespread impact.

As the industry changed, harvesting pressures and demands altered as well. Heavy harvesting in common-property areas is likely the greatest visible threat to existing oysters in South Carolina. The existence of SSGs was approved to give independent commercial shellfishermen, not holding leased grounds from the state, the ability to harvest shellfish. Unfortunately, these areas are heavily harvested to the point of possible overharvesting in some areas. Harvesters on SSGs are not required to replant the areas, and SCDNR's funding sources only allow for replanting on recreational beds, so these common-property areas are not being replanted and are suffering from habitat depletion. South Carolina's expanding coastal population also creates increased pressure on oyster resources, not only by adding more recreational harvesters, but also by indirectly closing harvest areas through non-point source pollution. Habitat loss can be mitigated through better management, closing areas to harvest, and implementing new replanting strategies; however, for any new programs to be effective, industry support for management changes is needed.

2.2 Statutory Authority

Two state agencies share responsibility for management of the state shellfish resources. The South Carolina Department of Heath and Environmental Control (SCDHEC), through the Bureau of Water's Shellfish Sanitation Program, is concerned with the public health aspects of shellfish marketing and consumption. SCDHEC classifies harvestable waters based upon the United States Food and Drug Administration's National Shellfish Sanitation Program (NSSP) Manual of Operations. NSSP requires states to show that shellfish harvest areas are "not subject to contamination from human and/or animal fecal matter in amounts that in the judgment of the SSCA [State Shellfish Control Authority] may present an actual or potential hazard to public health." SCDHEC classifications rely on regularly collected water samples from each approved harvest area to be tested to ensure it is below the established fecal coliform threshold as specified by NSSP. Water quality data have been collected continually at set sampling sites since 1986, allowing SCDHEC to update the acreage in each classification annually. Classifications are based on data collected during a standardized thirty-six month period ending December 31 of each year. SCDHEC's Shellfish Section is also charged with surveying the entire coast to determine where water quality issues can be mitigated. Surveys are required every three years; however, South Carolina surveys on a continual basis each year. Once pollution sites are found,

SCDHEC is to help in the restoration of these areas through the improvement of water quality. Although they are not directly involved in management, SCDHEC's Office of Ocean and Coastal Resource Management (OCRM) has regulatory jurisdiction over the coastal area and critical areas. OCRM grants building and dock permits in the coastal region, and therefore, can impact the management of the shellfish beds.

SCDNR is concerned with shellfish natural resource conservation and regulates commercial and recreational harvesters. Commercial harvest of shellfish through lease areas has been established since 1906, when legislation was passed to protect the resource from non-resident harvesters. Shell planting (returning shell cultch to propagate the resource) was required in addition to an annual fee per acre. Further legislation in 1924 gave rights for recreational harvest of shellfish from any oyster bed, leased or not. Abuse of this law by groups of people harvesting together for commercial purposes led to the establishment of public oyster grounds in 1959 for recreational harvesting. Recreational harvesters could no longer use lease areas, but instead were limited to harvest only from public oyster grounds. Public oyster grounds were planted occasionally with seed oysters by contract with commercial harvesters. In 1986, state laws governing shellfish resource management were changed to make state bottoms available for independent commercial harvesters (i.e. commercial harvesters without leases or culture areas) and three designations were assigned. Former leases were redesignated as Culture Permits (CPs) and SCDNR was given more authority to revoke permits if cultivation and/or annual rental requirements were not met. In addition to an annual fee, permit holders must cultivate their land through shell planting or alternative cultivation methods. Former public oyster grounds were split into two different bed types. The first is SSGs, where both commercial and recreational harvest is allowed. SSGs were also formed by breaking leases into smaller units when leaseholders failed to meet planting quotas or voluntarily returned bottoms to SCDNR. SSGs are managed by SCDNR through rotational openings and closings. The second is Public Shellfish Grounds (PSGs). PSGs are only open to recreational harvesters, and SCDNR routinely replants some of these areas as recreational saltwater license funds allow. There are also nine King's and legislative grants throughout the state, over which SCDNR has limited jurisdiction. The holders of these grants do, however, have to follow the harvest season and laws governing water quality. These grants are for intertidal areas only; the state owns all subtidal bottoms.

3.0 Existing Statutes and Regulations

Both SCDHEC and SCDNR have statutes and regulations regarding management of the shellfish resource in South Carolina.

3.1 SCDHEC Regulations

In order to protect public health, SCDHEC classifies shellfish harvesting areas based on water quality criteria found in South Carolina Regulation 61-68. Four classification designations exist based on fecal coliform levels: Approved, Conditionally Approved, Restricted, and Prohibited. Approved areas are those waters where shellfish

can be harvested for direct marketing or human consumption. Conditionally Approved areas, usually closed by rainfall events, meet the Approved area criteria under specific environmental conditions and time periods. These conditions are established by SCDHEC and are based upon NSSP standards specified in a management plan for each site. Restricted areas are state waters from which no shellfish harvesting for direct marketing is allowed. Shellfish may, however, be harvested with a special permit from SCDHEC and SCDNR and relayed to Approved areas or certified facilities for depuration, or self-cleaning. Prohibited areas are closed and no harvesting of shellfish for any purpose related to human consumption is allowed. In addition to the fecal coliform assays mentioned earlier for establishing water classifications, prohibited areas are automatically implemented near wastewater discharges, marinas and certain industrial uses.

3.2 SCDNR Regulations – Licenses

SCDNR laws govern shellfish harvest in Approved, Conditionally Approved, and Restricted areas (Code of Laws of South Carolina, Title 50, Chapter 5, Article 9). The shellfish season runs from September 15 through May 16 each year; however SCDNR may extend or shorten the season for biological reasons. SCDNR issues harvest licenses dependent on whether harvest is commercial or recreational. Harvesters who buy a commercial license cannot also buy a recreational license to take personal recreational limits. Recreational harvest is allowed on SSGs and PSGs. A resident of the state must purchase a $10 saltwater recreational fisheries license. There is also a temporary resident license, which lasts for 14 days and costs $5. Non-residents can buy an annual license for $35 or a 14-day temporary license for $11. Recreational harvesters can take up to two bushels of oysters and/or one half bushel of clams in any one day. No person may gather more than a personal limit on more than two calendar days per seven day period. In addition, regardless of the number of persons, only three personal limits per boat or vehicle are allowed.

Commercial licenses are further divided by whether harvest is on a CP or an SSG and there is no quantity limit for commercial harvest. CPs can only be harvested by the CP holder, or those to whom he has given permission. Harvesters need a saltwater commercial license ($25) and a harvest card with the decal indicating the CP on which they are harvesting. SCDNR supplies CP holders with area-specific decals that must be affixed to their harvest card and the cards of those who can harvest on their CP. SSG harvesters are also required to have the $25 saltwater commercial license in addition to a $75 shellfish license. Harvest cards are given to SSG harvesters with decals indicating the SSGs on which a harvester can work. A harvester can work up to five different SSGs at one time and needs a decal and map of the area (supplied by the SCDNR) for each. Additional licenses are needed for special types of commercial harvest. Commercial

harvest licenses for non-residents are $300 for a saltwater commercial license and $375 for a shellfish license. If harvest is not being done by hand, individual mechanical permits to harvest by hydraulic escalators, patent tongs, or drag dredge are needed. If harvesting at night on a CP, a night harvest permit is needed. Night harvest is illegal on state or public shellfish grounds. A SCDHEC and SCDNR joint relay permit is needed to take shellfish from beds categorized as Restricted and move them to Approved waters. Lastly, a washed shell permit is needed to take washed shell (partially abraded, less resilient shells found in the supralittoral zone) from state grounds and plant on a CP or SSG.

3.3 SCDNR Regulations – Harvest Area

SCDNR also handles the management of the Culture Permit area itself. CPs are designated by perimeter boundaries and each has an identification number assigned to the area. An individual or corporation can propose a new CP site by filing an application with an accompanying $25 fee. Individuals or corporations can also apply for an established CP site that was revoked by filing the same application and fee. The application must be for shellfish culture on naturally reproducing grounds. The applicant then advertises the proposed site in a local newspaper once a week for three consecutive weeks. SCDNR's shellfish permit committee addresses any written concerns from the public that are sent to the department during the advertisement period and decides whether to grant or deny the application. SCDNR surveys the area to determine the acreage of natural resource and maximum acreage of a CP area is 500 acres of oyster resource, intertidal, subtidal or a combination of both. Acreage is defined as the areas available for harvest, not the entire acreage within the CP area boundaries. GIS maps of CP areas are provided to the culture permit holder outlining the CP area boundaries.

CP holders are required to pay an annual fee of $5/acre, in addition to planting 50 bushels/acre of shell or approved cultch on their CP. The shell replanting requirement can be substituted by alternative methods such as hand raking (separating dense clusters of oysters), deploying live seed, concrete covered untreated wooden stakes, bamboo stakes, or concrete reinforcement wire, and other approved shellfish husbandry

methods. The permit holder must contact SCDNR prior to any planting and arrange for onsite monitoring. If any alternative methods will be used, a variance request must be approved by SCDNR before 15 June of each year. A SCDNR employee verifies that replanting is accomplished by monitoring the process or later visiting the site to note alternative method placement. CP areas are evaluated each year to determine if annual rent is paid and replanting requirements are completed. If the CP holder fails to meet either of these requirements, the state revokes the entire permit or a portion of it and may permit another user or make the area a SSG. Permits are viable for five years and the CP holder can renew the permit for another five years if the department agrees. CPs are not saleable, transferable or heritable and can be taken by the state if permit holders fail to meet permit conditions.

Mariculture areas are handled in much the same way as a CP area from an application standpoint. An application, with the $25 fee, is submitted and the application must state that the intent is for shellfish mariculture on grounds where shellfish are not found. The site is designated by a perimeter boundary, given an identification number, and the total bottom acreage is used to determine the annual fee (also $5/acre). Harvesters need a $25 saltwater commercial license with a mariculture decal indicating the mariculture area where he will be harvesting. In addition, the harvester needs a permit to possess undersize clams and a permit to harvest clams out of season.

3.4 Law Enforcement

Both SCDHEC and SCDNR personnel carry out law enforcement duties. SCDHEC officers generally enforce water quality area classifications and illegal harvesting in closed beds, while SCDNR officers enforce personal limits and harvest violations in management areas. Both groups, however, can enforce all shellfish laws and are informed of any regulation changes and problem areas through an annual shellfish workshop with SCDNR shellfish resource managers. A positive working relationship exists between the two agencies both in enforcement and management.

4.0 Current Management Practices

There are approximately 2,300 acres of intertidal oysters within the 571,010 acres of estuarine and riverine habitat in South Carolina. Resource management varies depending on the type of bed. There are presently 112 culture permits averaging between 10 and 15 acres each. The CP holder handles CP area management, with the minimum cultivation level being stipulated by law. Stakes and bamboo are allowed as an alternative planting technique, in addition to shell planting and alternative cultch such as limestone and wire. SCDNR personnel monitor all planting, and if the permit holder does not plant the specified amount, the permit will be revoked without appeal. A revoked culture permit is either reissued or redesignated as an SSG or PSG.

Revenue gathered through permit fees does not amount to a large sum, and is put into a general fund rather than being given back to the shellfish program for restoration.

Culture permit areas now make up approximately 85% of the harvestable intertidal shellfish beds in the state. SSGs make up 10%, with the remaining 5% in PSGs. The most heavily harvested beds, however, are mainly in the SSGs. There are presently 61 SSGs, ranging from 30-60 acres each. No appropriations were set aside for maintenance of SSGs and PSGs when they were created in 1986, so they have been managed passively. Management of these areas involves a resource assessment each year to determine if the area will be open or closed for the season, or open for recreational harvest only. In addition to a resource assessment, commercial harvest trends on that bed over the previous ten-years are taken into consideration. Presently, most state grounds are open during only half of the nine-month season, and some are closed for the entire season due to an evaluation of the previous season's condition. Although overall harvest levels have remained relatively stable using this process, continued long-term sustainability may require more active management (i.e. more field personnel), including increased shell replanting.

Shell replanting occurs on PSGs only through funds appropriated by the legislature for restoration. Each year approximately $100,000 of the state saltwater stamp revenue is given to the shellfish management program for replanting. SCDNR plants around 30,000 bushels of shell each year on the public shellfish grounds. State equipment is used to haul shell to a boat landing and load it on a barge, after an area is staked out for planting. The planting process is performed in late May through August by contracted commercial shellfishermen who were chosen by bidding on (a) how much they can plant for a given amount of money, or (b) how much they would charge for planting a specified amount of shell. South Carolina oyster shell is used in addition to purchased Gulf oyster shell (purchased from North Carolina for approximately $1/bushel) and purchased whelk shell from Georgia. Gulf shell is quarantined for three months to reduce the possibility of introducing disease or invasive species. No artificial substrate is used to plant public shellfish grounds and shell is planted whole.

The Marine Resources Research Institute (MRRI) handles fishery-independent work involving annual post-season qualitative assessments, natural population assessments, recruitment and early growth research, and work on shellfish disease. Recent disease levels have been comparable to results observed from other South Carolina oyster population studies since the 1990s. Historically, *Perkinsus marinus* (Dermo) has been present throughout the year in South Carolina, and it is unlikely that any South Carolina oyster populations are free of the disease, but levels of infection are at relatively low intensities. *Haplosporidium nelsoni* (MSX) prevalence during the summer-fall assessments has remained at low levels since 1996. Quahog Parasite

Unknown (QPX) is the first recognized disease associated with hard clam mortality; however, a small-scale survey of clams in South Carolina did not find evidence of this disease.

Oyster restoration and enhancement efforts are handled by both MRRI and the Office of Fisheries Management (OFM) and include large-scale replanting supported by saltwater license revenues, small-scale community-based restoration through the SC Oyster Restoration and Enhancement (SCORE) program, and the shell recycling program. The shell recycling program in South Carolina is four years old and has one permanent employees and one part-time employee in charge of recycling and planting. Presently SCDNR plants about 30,000 bushels/year, only on public areas. For the first time in 2004 planting occurred in a restricted area to establish oyster habitat and potentially improve water quality. Eight hydraulic dump trailers have been placed at sites for shell drop-off for a total of 13 drop off sites. Trailers are also delivered to large events for caterers of oyster roasts. Harvest bags with the logo, "Complete the Cycle – Recycle your Shells" were delivered to oyster retailers to distribute with their oysters promoting the recycling program. The program has worked well and the amount of shell being recycled each year has increased indicating an increasing popularity.

5.0 Trends in Shellfish Grounds

Water quality can have a great impact on the shellfish industry since beds are classified according to SCDHEC water quality test results. Declines in water quality result in reduced acreage being classified as Approved and, consequently, a decrease in harvestable grounds. As seen in Figure 1, approximately 70% of the shellfish growing areas are Approved, 20% Restricted, 10% Prohibited and a very small percent Conditionally Approved. The percentage of Approved areas relative to total acreage has changed little in recent years. Approved and Restricted area percentages are mainly affected by meteorological conditions. During rainy years there is an increase in Restricted Areas,

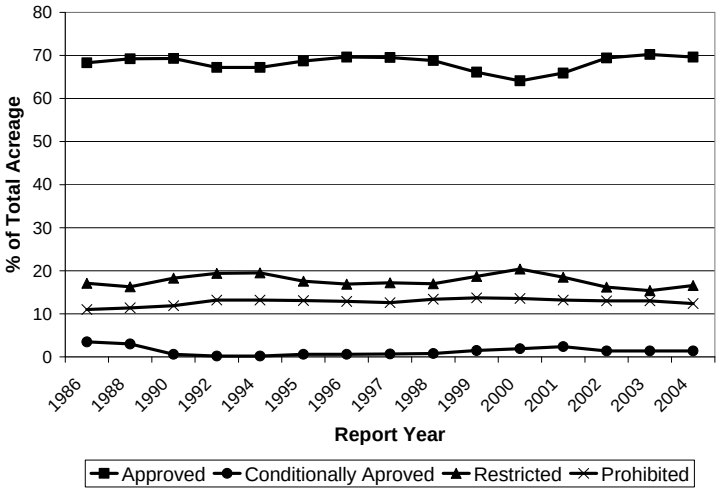

Figure 1: Percentage of shellfish ground acreage divided by classification type.

while during drought years there is an increase in Approved Areas. Conditionally Approved and Prohibited Area changes are usually related to administrative management concerns. Overall, there seems to be relatively stable water quality throughout the state, with any changes in one area being compensated for by changes in the opposite direction in other areas.

One of the greatest impacts on the quality of the resource and the landing totals is the number of harvesters permitted each year. Figures 2, 3 and 4 show trends in the number of permits issued to commercial shellfishermen for harvest on state grounds, Culture Permits and Mariculture Permits, respectively. Since one holder can have more than one CP or mariculture permit, this does not match the number of CPs or mariculture permits total. All are graphed by the starting year of the harvesting season. After 1992 there was a trend of decline in the number of independent harvester permits on state grounds until 1997 (Fig. 2). Since 1997 there appears to be a cyclic trend with alternate years having a difference of 50+ permit holders. The health of the economy has an effect on the number of harvesters present in the industry. Years with a weak economy tend to have a higher number of harvesters, while strong economy years have a lower number. These changes are most evident in the counts of individual commercial harvesters, since CPs are more permanent commitments. Commercial harvesters working on state grounds do not have a harvest limit like recreational harvesters. Therefore, it is not possible to directly relate the number of harvesters to the amount of shellfish harvested. However, generally it can be assumed that more independent harvesters would take more shellfish off the state shellfish grounds.

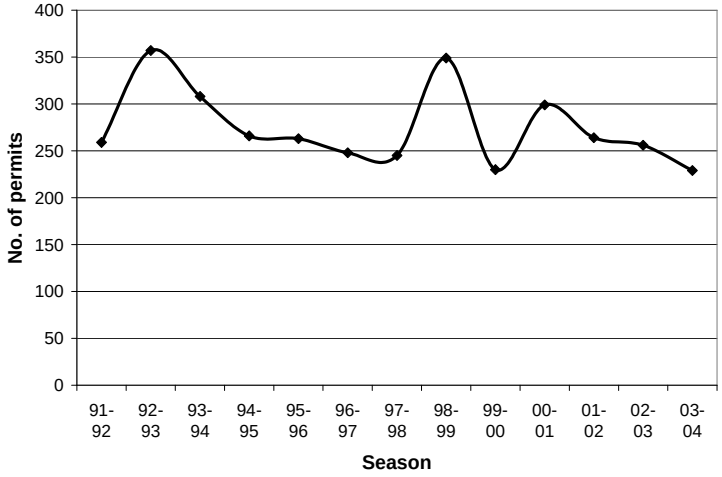

Figure 2: Number of state ground permits issued each season. State grounds permits are for commercial harvesters.

Figure 3 shows a dramatic increase in the number of CP holders after the law changed in 1986 because the areas were reevaluated and more commercial shellfishermen

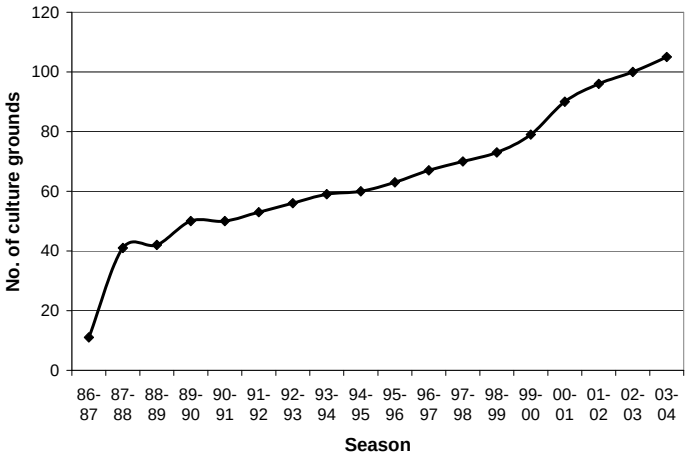

Figure 3: Cumulative number of Culture Permit holders each season.

were encouraged to obtain culture permits. Some leases were also subdivided into several CPs, which affected the count numbers. Since then there has been a steady increase in the number of people holding CPs. With the exception of 2000, 8 or fewer new CP holders are permitted each year. The number of harvesters working each CP is controlled by the permit holder, but the total number working all CPs is obviously in excess of the number of CPs.

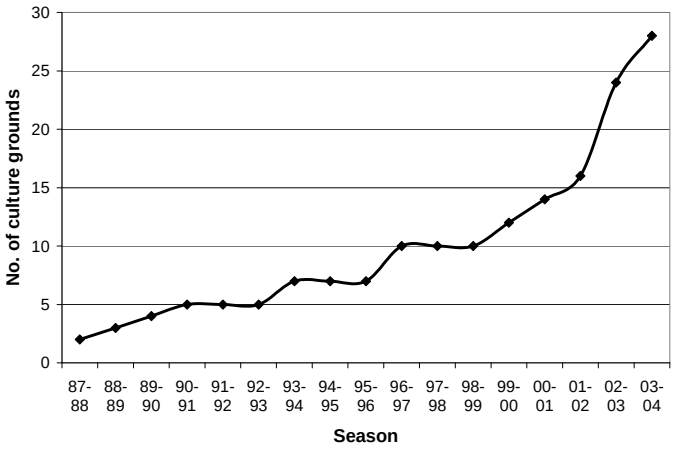

Figure 4: Cumulative number of Mariculture Permit holders each season.

Figure 4 shows a general, but uneven increase in the number of mariculture area holders permitted each year. Since 1988 the rate of mariculture areas permitted has increased, indicating a rise in the interest in clam mariculture. The number of permits may be expected to rise assuming market conditions warrant more production.

Landings data are shown in Figures 5-11. Figure 5 shows the total commercial oyster landings in South Carolina from 1950-2003. Note the major drop in the oyster harvest that has only recently leveled off. The most plausible explanation for this large drop is a shift in the labor force which eventually caused the industry to be transformed from cannery-based to a shell stock system. During this time the pay scale for jobs in other industries increased, the industry's labor base dropped significantly as people took other jobs, and the canneries closed. Other economic forces, namely cheaper imports, also helped force the canneries out of business. Since the canneries accounted for most of the production, landings decreased dramatically. Since 1989 the harvest level has been more stable.

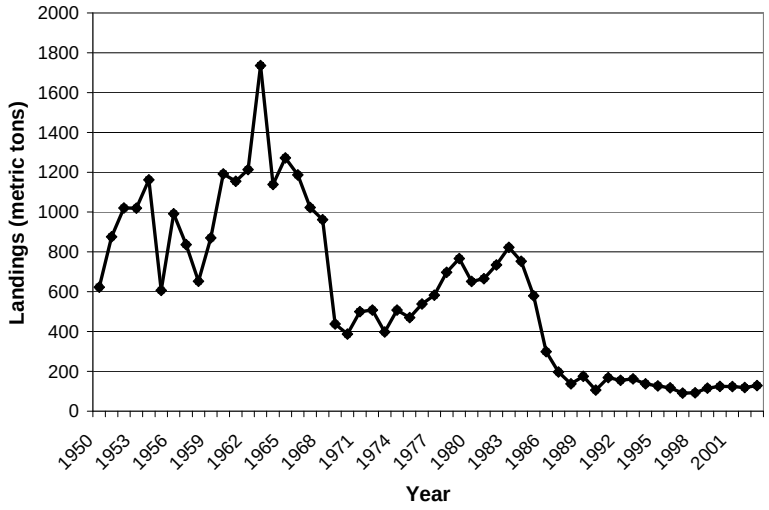

Figure 5: Total oyster landings in metric tons from 1950-2003.

A more detailed picture is shown in commercial data collected since 1991 divided into SCDNR harvest management areas. Figure 6 shows the total oyster landings per season separated into harvest area sections. The overall oyster harvest dropped after the 1993-94 season and has still not yet recovered to that level. Harvest from the CP areas

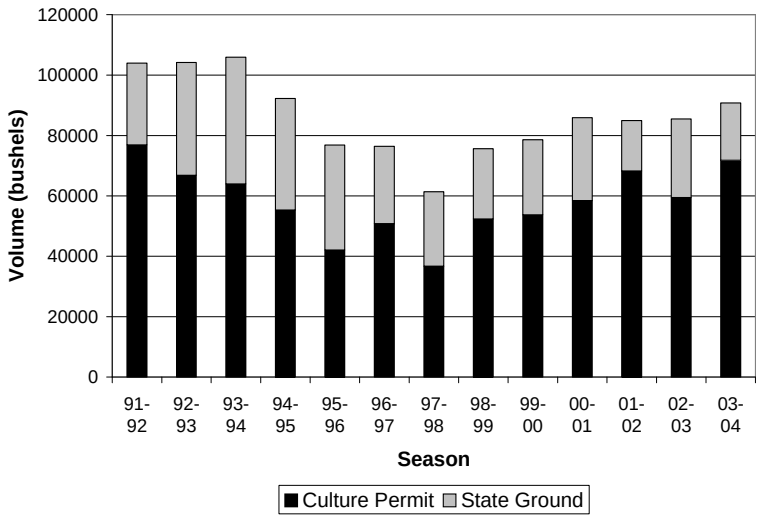

Figure 6: Oyster landings by season. Bars divided by the harvest area type.

showed a drop and subsequent increase in landings, with the 2001-02 season close to the 1991-92 level. SSG harvests, however, did not decrease greatly until the 1996-97 season and has not recovered from that drop in production.

Figure 7 shows oyster landings from the CPs and SSGs separately. The CP areas again show a decrease in harvest from 1991-1996 and a subsequent increase since 1998, with the most recent season landings (2003-04) being the highest in nine years. SSGs have had a much less dramatic change, but the change is continuously negative. As mentioned previously, the state of the economy has an influence on harvest; however, not all decreases are related to the economy. The rather significant drop in SSG landings during the 2001-02 season may be an anomaly or it may be the beginning of a more dramatic decrease in harvest. Approximately 30% of the oysters are harvested from SSGs with around 70% from CP areas. The exact percentage varies slightly each season, but is relatively stable.

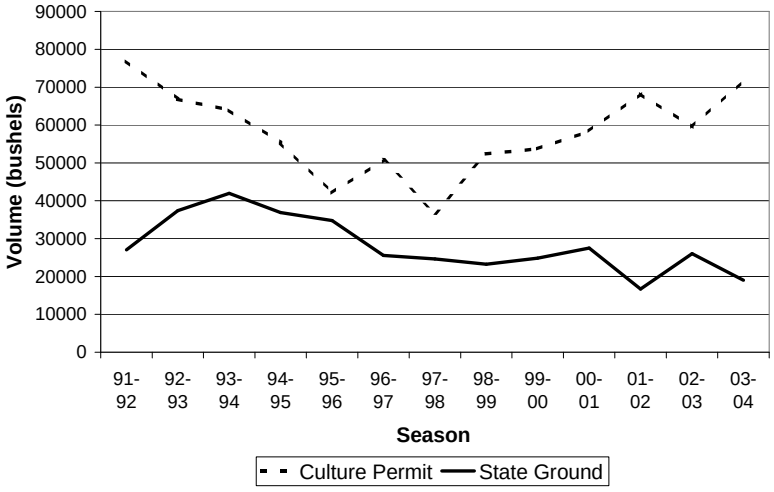

Figure 7: Oyster landings by season from Culture Permits and SSGs.

Commercial clam landings are summarized in Figures 8-10. Figure 8 shows the total commercial clam landings in South Carolina from 1950-2003. Clam harvests increased greatly after 1975, mainly as a result of mariculture. The recent drop in official reported mariculture landings results from a law change in 2000 making it optional to report mariculture landings since mariculture clams are now considered an agricultural product rather than a fishery product. Clam mariculture is a major portion of the shellfish industry with an estimated 5.5 million dollar farm gate value in 2004. The

selling of seed clams is a large part of the industry in South Carolina, in addition to the sales of clams for consumption.

Figure 9 shows the importance of mariculture landings to the total season landings total. Note how closely the two lines follow each other. Since 1994, nearly 60% of season totals are accounted for by mariculture. CP areas account for 30-40% of the wild stock harvest during each season and SSGs account for 20-30% each season. Figure 10 compares the landings from mariculture to the wild stock landings (harvest from SSGs and CP areas). The fluctuations seen in mariculture landings are not present in wild stock landings. Wild stock harvest is more stable over each season, although there is some variation, due likely to the economy, competition with mariculture clams, and the number of areas opened for hydraulic escalators.

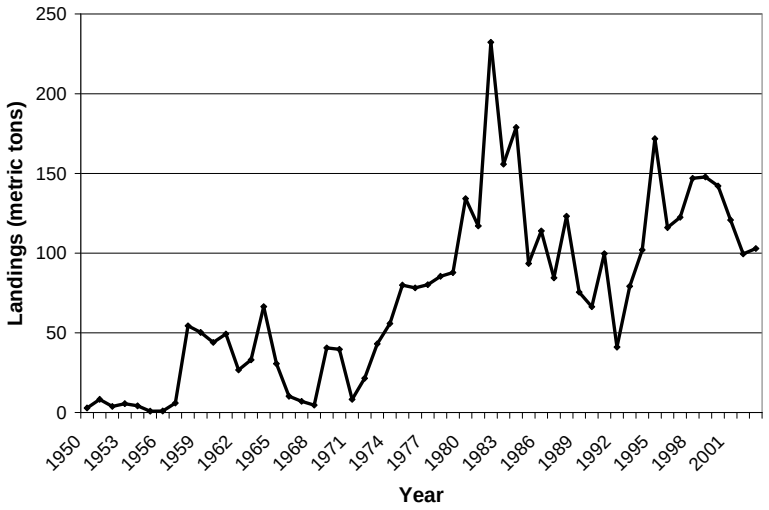

Figure 8: Total clam landings in metric tons from 1950-2003. Note: law change in 2000 no longer requires clam mariculture landingsto be reported.

Overall, both the CP areas and SSGs seem to be sustaining the harvest levels placed upon them. State beds are beginning to show a drop in oyster harvest. This could indicate a possible stress on the resource or the drop could simply indicate less harvesting and may be due, in part, to increased SSG closures by SCDNR and SCDHEC in recent years. These beds are rarely replanted, and this drop in harvest may be a result of the difficulty in meeting the demand with only passive management. It may be necessary to either reduce harvesting pressure or initiate more replanting effort to keep

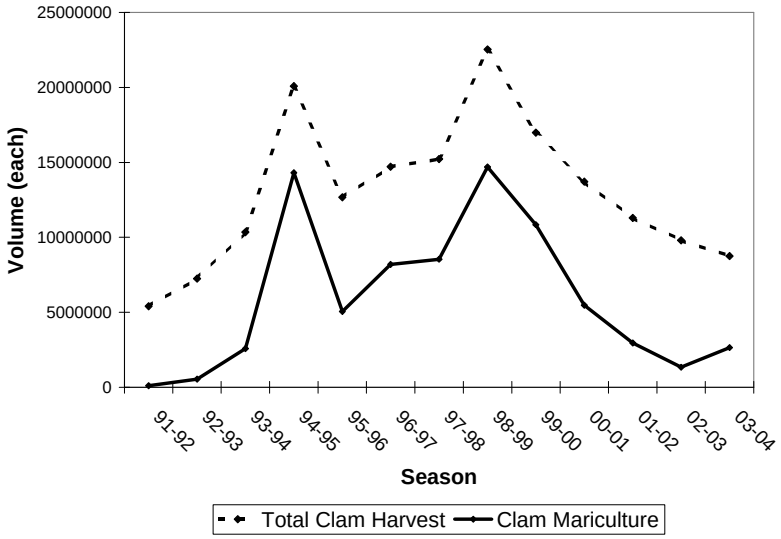

Figure 9: Total clam harvest compared to clam mariculture harvest each season.

these beds producing shellfish at their present level. Harvest control could come in the form of limiting the number of harvesters or limiting the daily commercial catch. Unlike the recreational harvesters, commercial harvesters do not have a daily or weekly limit. Rather than controlling the number of harvesters, it may be less problematic to impose a commercial limit on SSGs. Increased oyster landings on culture permits seem to make up for decreased landings from SSGs in recent years. Continual maintenance planting of CP areas is required, and this may be a major factor in keeping them viable. Increased shell replanting efforts on SSGs could keep harvest at levels acceptable to the commercial and recreational demand. Planting can be done by the state, a commercial contractor, or the independent commercial harvesters working the SSGs could be required to replant the areas they harvest. Since multiple independent commercial harvesters work each SSG, the planting requirement placed on each would be manageable, with additional SCDNR field personnel to monitor cultivation. Alternative culture methods can be used in an attempt to start new beds in SSG areas devoid of oysters. Independent commercial harvesters could then be granted a variance for planting these areas. State government planting is considered to be the recreational harvester's contribution, since the program is paid for by recreational saltwater license funds. With increased funding to provide shells, monitoring personnel and equipment, planting by both the state and the independent commercial harvesters could allow public beds to not only sustain their present level of harvest, but also increase their production in the future.

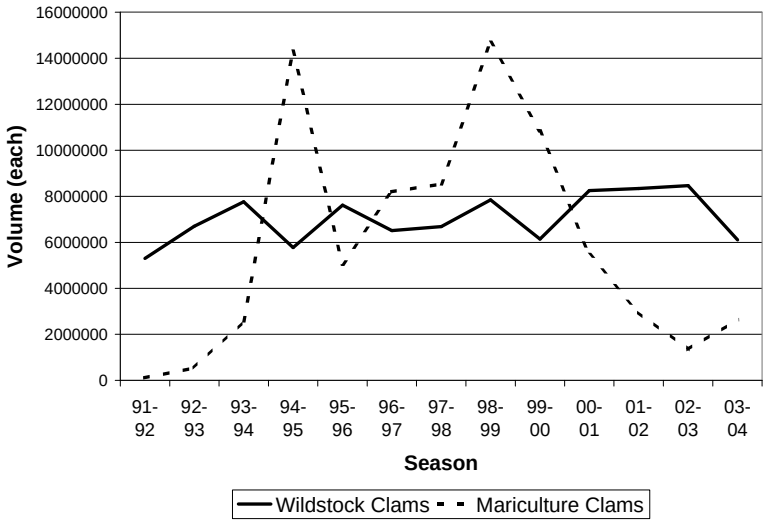

Figure 10: Wildstock clam harvest compared to mariculture clam harvest each season.

6.0 State Management Comparison

The states of Maryland, Virginia, North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas were contacted and their laws and regulations regarding shellfish were compared with South Carolina regulations. Appendix 1 includes three tables that summarize information gathered from the states. A meeting for state managers was also held in Jekyll Island, Georgia in April 2004 during the Gulf and South Atlantic States Shellfish Conference. Appendix 2 summarizes the information gathered at the meeting and contains three tables comparing the states' management techniques. Below is a summary of some of the similarities and differences noted. Please refer to Appendix 1 and 2 for a more in depth discussion.

Bottom leasing is allowed in nearly all of these states for personal or commercial use (see Table 1 in Appendix 1). Alabama has not leased state bottoms since the 1980s, but does allow property owners to file for harvest and cultivation rights on land up to 600 yards from their waterfront if no natural resource exists. The property owner may allow others to harvest on this area but must provide the department with the names of harvesters. Texas allows leases, but at this time has a moratorium on new lease areas. All other states allow leases or, in the case of South Carolina, Culture Permit areas. Louisiana, Maryland and Virginia require a survey fee with the lease application, which is used to cover costs for determining an area's feasibility for shellfish culture. All other states, except Mississippi, which has no application fee, require a set fee to apply for an area ranging from $25 in South Carolina to $200 in Florida and Texas. Maryland uses an abated fee level for beds known to be located in disease prone areas. Georgia uses a competitive bidding process to determine lease areas, and the survey fee is included in the bid. Renewal times vary by state from 5-25 years.

All states with leasing programs charge a yearly fee for use of lease area, usually determined by acreage. This ranges from $1.50/acre in Virginia to $15.95/acre with an additional $10/acre surcharge in Florida. Acreage is determined by total surface area in all states except South Carolina, where it is determined by area of the intertidal oyster resource. In Georgia, the fee/acre is dependent on the sale price of the shellfish product. Mississippi uses a bidding system to determine the yearly fee; however, the fee must be more than one dollar per acre. States also set a maximum acreage allowed within a lease area. This ranges greatly and is likely dependent mainly on the density of the shellfish beds in specific states and the attitude of the shellfishermen towards the leasing process. All states call for owners to plant and maintain their own leases, with Georgia, North Carolina and South Carolina requiring a certain level of shell planting on each lease. Virginia taxes sales, which provides state funds to replant shellfish beds. Another management technique used in Mississippi, North Carolina and Virginia is requiring a set harvest level for lease areas. Maryland requires lease owners to meet either a harvest or replanting condition. Texas leases are used almost exclusively for relay and depuration; therefore, there is no replanting or required harvesting.

Management fee structures (see Table 2 in Appendix 1) differ greatly by state and are dependent on the type of harvesting done in the state. Permits to harvest shellfish commercially range from $12 to $200. Maryland permits are dependent on the species harvested; Mississippi permits are dependent on the harvest process; and Florida permits are dependent on the harvest area. Most states have additional permit fees beyond the general commercial harvest permit for tong or dredge use. Texas permits the boat and captain instead of each person harvesting, since most shellfish are dredged and, therefore, the number of boats is the important factor. Texas does have an individual commercial license; however, few, if any, are bought each year. Mississippi has a boat fee that depends on the size of the boat, and Florida has a set commercial vessel fee. North Carolina allows the use of either a standard commercial fisherman license or a specific commercial shellfisherman license, which differ in price. Alabama, Florida, Louisiana, Mississippi and Texas charge a bag or tag fee on landings and the taxed size is listed in Table 2 to allow comparison.

Table 3 in Appendix 1 gives information on the percentage of shellfish beds dedicated to public versus lease or permit areas and information on shell recycling and

mariculture efforts. It is important to note that most states determine acreage by total acreage not the acreage in which shellfish beds are located exclusively. It is also important to note that the public acreage in Florida refers specifically to acreage in Apalachicola Bay. Florida, Louisiana, South Carolina, and Virginia dedicate 20-30% of their shellfish beds to lease acreage. Texas sets aside approximately 11%, and Alabama, Maryland, Mississippi and North Carolina designate less than 5% of their shellfish beds exclusively to lease areas. Georgia on the other hand has over 60% of their beds dedicated to leases. These differences likely are due to each state's history and attitude towards the benefits of lease areas for the industry in their state. All Atlantic states have some sort of shell recycling program, while these programs are not common and are just now being investigated in most Gulf States. Florida, Texas and Virginia claim a certain portion of the harvested shells by law, which may be beneficial in sustaining a shell recycling program because of the high price and low availability of empty shell. More information on the recycling programs is available in Appendix 2.

Atlantic states allow mariculture within lease areas and, in the case of Florida, place leases in high-density areas to contain mariculture to specific areas. On the other hand, Texas and Louisiana do not allow shellfish mariculture in lease areas, and these areas are generally designated for relay and depuration rather than mariculture sites. Gulf States do not have the demand for mariculture seen in the Atlantic states, likely because they do not have hard clams. It is useful to note the similarities and differences between state programs, and it is clear that each state has its own priorities set by both the shellfishermen and the public in that state.

7.0 Stakeholder Interview Results

7.1 Staff Interviews

Eleven staff members from SCDHEC and SCDNR were asked to respond to a number of questions regarding their overall perception of the state of shellfish management and the management framework. Questions used to guide discussions and responses by staff members interviewed are present in Appendix 3. Speaking to staff and reviewing their answers revealed there are a number of recommendations for efficient and positive future direction for the department. These are listed below; please see Appendix 3 for a more detailed discussion of the interview responses.

- Consider the non-consumptive value of the resources. The condition of the resource for habitat, erosion control, and water quality are equally if not more important than consumptive use and should be considered equally when deciding what beds to open.
- Increase cooperation within SCDNR, between OFM and MRRI. Collaboration is necessary in order to assist with sharing of information, determination of needed research, and assistance for management decisions.
- Increase replanting for the health of the resource and increase funds to allow better planting efforts.

- Amend SSG management legislation. Many options for SSG management were discussed and are summarized in Appendix 3.
- Find a way to better estimate the level of the recreational harvest – this could be done by requiring saltwater license applicants to note whether they harvest shellfish, what kind, and approximately how many times a year they harvest, by sending postcard surveys to license holders, or by conducting creel surveys at public boat landings.
- Obtain mariculture landings – it is important for the department to show the strength of the mariculture industry and landings are necessary for this purpose. It is also important for management decisions, such as where to place mariculture permits.
- Obtain Catch Per Unit Effort (CPUE) information – effort should be considered to properly determine the usage of SSGs. With this information management could determine whether changes in landings were due to a drop in resource availability or change in effort.
- Review retail shellfish control – the recent removal of SCDHEC's control of retail shellfish sales could prove to be a major problem in the future. The tagging system is in place to track shellfish in the event of human illness and without the ability to check retail facilities, a major section of sales is being ignored.
- Reinstate the combined point system – since tickets for shellfish violations are given from both departments, a combined point system should be reinstated.

7.2 Industry Interviews

Seventeen members of the shellfish industry were asked to respond to a number of questions regarding their overall perception of the state of shellfish management and their feelings towards possible management changes. Questions used to guide discussions and responses by industry members interviewed are present in Appendix 4. After speaking to industry members and reviewing their responses, there are a number of recommendations for management changes. These are listed below; please see Appendix 4 for a more detailed discussion of the interview responses.

- Increase replanting of beds, especially State Shellfish Grounds.
- Increase information to reduce misunderstandings and boost effectiveness. Include information to recreational harvesters on where to harvest, information to harvesters on the reasoning behind certain regulations, and information to sellers on marketing techniques to improve the sale of South Carolina shellfish.
- Revise Culture Permit requirements so that CP holders must use their beds rather than being allowed also to harvest from SSGs.
- Change the management of SSGs. This was one of the most often discussed topics, and industry members suggested a number of options for

decreasing the stress placed on these beds. Suggestions given by respondents are discussed in Appendix 4.

- Allow shell to be purchased and planting funded as mitigation for coastal disturbances through coastal zone and stormwater permitting.
- Require cull in place or place a limit on the percentage of dead shell allowed per bushel.
- Review paperwork requirements and determine if any can be combined or set up in digital format.
- Review process for notifying harvesters of closed beds and use electronic message or automated phone number rather than mail.
- Allow a time period for training of new personnel before the departing personnel leave. The industry respondents stressed the importance of their contact and relationship with state employees as the reason for good relations with the department. For this reason and the huge amount of historical knowledge lost when personnel leave, there should be an overlap of employees to provide proper training.

8.0 Needs and Recommendations

Through the examination of South Carolina's shellfish industry and shellfish management framework, a number of issues were found that should be handled in the near future to insure proper regulation of the resource. The following is a list of recommendations for management options the departments can consider.

8.1 Departmental Considerations and Planning Meetings

The majority of staff members noted the importance of shellfish habitat/resources beyond their consumptive value; however, this value is not as tangible as user rights and many times is not considered in equal standing when making management decisions. The departments do an excellent job considering the needs of the industry, as demonstrated by the understanding and respect seen between industry and department representatives. This should not be ignored or weakened, but the condition of the resource for habitat, erosion control, and water quality should be given a quantitative value when deciding which beds to open and how to handle regulation changes.

The department should use information gathered by the MRRI research division for understanding environmental impacts and determining how beds are recovering. Some beds have the ability to be heavily harvested year after year and recover during the summer months; however, some cannot recover as quickly and are being hurt by continued harvest. The impact of harvest on resource quality and quantity scores during the yearly assessments should be investigated, as well as the impact of not cultivating certain areas. Collecting additional information and making it available to all with a management responsibility would also improve the efficiency and success of the department. A central database with information and reports should be shared between OFM and MRRI to allow intra-agency coordination.

During staff interviews, a comfort with the level of cooperation between SCDHEC and SCDNR was noted. Quarterly meetings have facilitated inter-agency cooperation

and respondents noted the importance of the meetings as a way to avoid potential problems. Cooperation between SCDHEC Shellfish Sanitation and SCDNR seems to be improving greatly as a result of the meetings; however, OCRM should also be included to increase communication. There were a number of those interviewed who indicated disagreement with permitting decisions made by OCRM based on the proximity of these permits to shellfish beds. These issues need to be brought to OCRM's attention, and a process for considering alternative permits should be investigated. In addition to increased representation at the quarterly interagency meetings, similar meetings, set up three or four times each year, should be held within SCDNR, specifically between OFM and MRRI. In this way, research needs, management suggestions, harvester complaints, resource health, and future planning could be discussed regularly in a more open forum. It would also be beneficial to have the duties of each department clearly defined to avoid disputes, communicate needs and remove redundancy. Including the Environmental Evaluation Section should be considered since this department comments on any permits impacting shellfish and shellfish harvesting. Inclusion of this section at meetings would help to share information on permit practices and increase understanding within the agency.

8.2 Replanting Funds and Efforts

Nearly every staff and industry member interviewed felt that increased shell planting is necessary to keep the shellfish resources healthy and sustainable. Looking for new funding sources, increasing public knowledge of the recycling program, and working on extending planting to SSGs are three ways to most effectively increase replanting. Increased fees are needed most importantly for planting equipment and staff, but also to purchase shell. Increasing the public knowledge of the recycling program would assist in obtaining shell, and would increase public awareness of shellfish issues. While it will be politically difficult at present to expand replanting to SSGs, it is necessary because of the heavy harvest on these areas by both recreational and commercial harvesters.

If the state wants to keep common areas open, rather than having only leased areas, SSGs must be replanted or provided longer rotations. The beds that should be targeted are those that receive the most harvest pressure. Six SSGs account for 86% of the SSG landings and ten SSGs account for 97%; so these areas should receive the bulk of the attention from SCDNR. Since both OFM and MRRI are involved in the planting process, planning meetings should be set up before the planting season to review the beds to be planted, the type of shell and planting specifications for each, and the monitoring process. Planting should also be done as early in the spat season as possible for the greatest possible success while also allowing for unexpected problems with contractors. Harvesters in the area should be considered as a resource for advice on where the best planting sites might be located. This information could be collected at the 'shellfish workshops' held each September. Planting contracts need to be much more detailed regarding requirements of the contractor, including minimal equipment requirements. It would help if contracts were awarded for an extended period of time, at least one planting season, preferably three to five years. This would allow the person awarded the contract time to refine the planting process, and would give him incentive to have working equipment and invest time and energy into the task. These pre-planting measures may

help lessen the number of times plantings do not meet design measures. Extended contract awards and early planning may alleviate some of the issues that have delayed planting in the past.

An effort to increase the amount of native South Carolina shell planted in the state should be undertaken. There are multiple ways in which other states handle shell. Florida owns half of the shell taken from state waters, which allows harvesters/distributors an option for what to do with the other half of the shell, but returns a good portion to the state for replanting. It is a better and less contentious option than having the state claim all shell harvested from state waters since shell is such a valuable expensive commodity to other industries. While it is understood that the distributors can choose to sell some shell, they should be required to give a portion back to the state for the health of the industry from which the shell came. Another option is to charge a per bushel tax or charge harvesters for tags that are used to mark bushels harvested. The bushel tax or tag fee should then be used exclusively for purchase of shell for replanting. Obtaining more shell so that more areas can be planted should be a priority of the replanting program.

8.3 Culture Permit Area Revisions

Overall CP areas are well managed, however, there were a few suggestions that would help the sustainability of the resource and the ability of the department to manage it properly. First, replanting in CP areas should be more stringent, requiring methods that increase the amount of resource, not simply the commercial value. Shell planting should be more than simply encouraged, it should be required in a certain percentage on each CP area, and variances should be given for only a small portion of the replanting requirement. The industry respondents would support a small fee increase for use of CP areas, but stated that they would only support the increase if fees were used for cultivation of other areas. For this reason the fee should not be increased if the shellfish office does not directly receive the funds. One way to increase funds without increasing fees is to review and add areas that are being harvested subtidally to the annual fee. Finally, it would be a good idea to consider adding a usage requirement to permits. This would encourage CP holders to turn unused areas over to the state. These areas could then be turned into additional CPs, as suggested by a number of industry members interviewed, or added into the acreage for SSGs. It would also help to encourage CP holders to use their areas, rather than SSGs, which would ease an issue raised by a number of interview respondents.

8.4 State Shellfish Ground Revisions

Because SCDNR has been directed to develop and maintain SSGs, it has the authority to control their harvest. Industry members overwhelmingly felt that the health of the resource and the level of harvest could be attributed most directly to harvest methods and the number of harvesters. They also felt that SSGs were not being managed in a way that will promote long-term sustainability. Staff members agreed and nearly every person interviewed said SSGs were the area of biggest concern. The format of having SSGs,

PSGs, and recreation-only SSGs should be reviewed. A number of suggestions were discussed during the interviews. These mainly focused on increasing the acreage provided for SSG harvest and/or increasing the ability of the department to replant areas under its control.

1) It would be less confusing and possibly better for shell planting funding purposes to combine all public grounds into one category. Certain beds could then be sub-classified as recreational only and those beds could be replanted. The sub-classification could be changed each year depending on the state of the resource in that area and its need for replanting. Acreage would increase if unused areas from CP areas were being handed over to SCDNR and turned into public harvest areas. With increased acreage, heavily harvested beds could be taken out of commercial harvest rotation for a year or longer, replanted and allowed to recover.
2) Having hybrid CP/SSG areas would be a major change in how the beds are handled, but might help alleviate the problem of beds being unplanted year after year. A usage requirement on CP holders would give an incentive to allow harvest by independent harvesters on unused portions of their CP area. In this way, the independent harvester would not be removed from the industry, and unused portions of the CP areas would be used. CP holders could then require harvesters to help in the replanting process, which would insure all beds in the state are being actively managed.
3) If increased replanting is not feasible due to budget or staff restraints, SSGs need to be given time to recover before being put back into commercial harvest use. All public areas can be broken into three groups, spread evenly throughout the state. Each year one group would be open to commercial harvest, with the next area being rotated into harvest the next year to allow each group a two-year recovery period. This option, however, would require increased acreage in order to allow enough resource area to be opened each year.
4) Many industry members interviewed supported the idea of requiring independent harvesters using public beds to replant those areas. It would be most sensible to require the harvesters to provide the SCDNR with an amount of shell dependent on how much they harvested, which could then be replanted in a large scale departmental planting. Other states have dealt with this problem by placing a tax on each bushel harvested from public grounds, or legally claiming all shell as state property. With the lack of shell being one of the largest problems, it would be better to require that shell be returned rather than to apply a tax to harvest.

8.5 Information Exchange with Industry

There were a few areas noted by industry interview respondents where more information could decrease misunderstandings and increase effectiveness of shellfish management. The first noted by nearly all those interviewed is increased information for recreational harvesters. It was stated that there should be more information on the harvest limit, which beds are open for recreational harvest, and where to obtain maps.

Secondly, a number of the industry members interviewed had questions regarding the meaning of specific laws and determining which laws are ISSC regulations. Informational meetings like those held in 2004 prior to the start of the shellfish season should be planned each year to continue information exchange between SCDHEC, SCDNR and the industry. Finally, while DNR should not help market shellfish, it could help support the South Carolina Shellfish Association by seeking and giving advice. The association could be used as a point of contact, which would increase its importance in the eyes of those in the industry, while giving the industry a combined voice.

9.0 Summary

With the growing pressures placed upon coastal habitats as development along the coast expands, the continued health of shellfish resources is increasingly important. Shellfish habitat serves as coastal erosion buffers, water quality filters, and nursery grounds for other species. The shellfish resource is also in high demand for harvest, and must be managed to allow continued industry use. Recommendations for management changes were formulated based on comparisons with other states and interviews within South Carolina. These included considering the importance of shellfish resources beyond their consumptive value when making management decisions, increasing the number of inter and intra-agency planning meetings to streamline management, increasing replanting funds and efforts, reviewing Culture Permit and State Shellfish Ground management, and continuing information exchange with the industry. SCDHEC and SCDNR employees are highly regarded by industry members and continued cooperation with the industry should be a goal. Both the industry and the public should be included on further discussions of management changes to insure support when new legislation is considered. A series of intra-agency meetings and public meetings to determine the best course to follow is highly suggested. Through this process, the resource, the industry, and the public use of this important species could be considered and accounted for in any management changes.

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Appendix 1: Gulf and South Atlantic State Shellfish Policy Comparison

Table 1: State leasing program components.

	Fee/Acre	Max. Acreage	How Acreage determined	App. Fee	Lease Replant	Misc. Lease Requirements	Length of Permit
Alabama*	only property owner has right to harvest	up to 600 yards from waterfront property	N/A	no fee	no requirement	property owners provide list of harvesters on area	N/A
Florida	$15.95/acre, $10/acre surcharge	2 average, 5 clam, 10 for oyster	total surface	$200	no requirement	plant and maintain own lease	10 yrs.
Georgia	dependent on sale	usually >200	total surface	competitive bidding	33.33% of taken	clam replant 1:1 year 1; 2:1 year 2; 3:1 rest	5 yrs.
Louisiana	$2	2500	total surface	min. $200 survey fee	no requirement	N/A	15 yrs.
Maryland	$3.50	Counties range 30-100, Bay waters 500	total surface	$300 survey fee	no requirement	plant or harvest at least once in 3 yrs.	20 yrs.
Mississippi	bidding - more than $1 /acre	100	total surface	no fee	cultivate, plant or harvest each year	if rebid pay old lessee	rebid 25 yrs.
North Carolina	$5	50, must demonstrate need	total surface	$100, renew $50	25 bu. seed or 50 bu. cultch /acre	must harvest and sell 10 bu. per acre each year	10 yrs.
South Carolina	$5	100 surface, 500 bottom	area of resource	$25	50 bu./acre	can use alternative cultch	5 yrs.
Texas**	$6	100 each lease, 300 total for all leases	total surface	$200	no requirement	leases for relay/depuration	15 yrs.
Virginia	$1.50	250 each lease, 3000 total for all leases	total surface	$25 + survey	tax of 10-50 cents per bu. ***	no renewal if no sig. prod; plant and maintain	10 yrs.

* Alabama has no state beds under lease since 1980's
** Presently Texas has a moratorium on new lease areas.
*** Tax is dependent on the price oysters were sold for and the area taken from

Table 2: State shellfish management fee structures.

	Comm. Harvest Permit	Rec. Harvest Permit	Other Fees/Permits	Other Fees/Permits	State Tax or Bag Fee
Alabama	$26	no license	N/A	N/A	$0.25 per tag*
Florida	$50 or $100 for App. Bay	$13.50	$50 aquaculture certificate for lease	commercial vessel $100	$1/bag* in App. Bay
Georgia	$12	$9	shellfish pickers free	N/A	no fee
Louisiana	$55	$6	oyster captain $100, saltwater vessel $15	per barrel* (2.5 cents on lease, 3 cents on public)	15-45 cents per tag* depends on quantity
Maryland	$50 oyster, $100 clam	no license	N/A	N/A	no fee
Mississippi	$100 dredge, $50 tong	$10	may be a wetlands permit fee	boat fee dependent on size of boat	$0.15 per sack* from harvester and first dealer
North Carolina	$200 standard or $25 shellfish	$35	shellfish endorsement on standard	Aquaculture operation permit - no cost	no fee
South Carolina	$25	$10	$75 harvester	same app and acreage fee for mariculture	no fee
Texas	$30 captain*	$23 license + $10 saltwater	$420 commercial oyster boat	$12 sport boat	$1/barrel
Virginia	$150	no license	$10 oyster by hand	N/A	no fee

*** State tax / bag fee size comparison**
Alabama tag per sack = 1/4 AL barrel = 1.23 cubic feet
Florida bag = 10 gallons or 60 pounds
Louisiana tag per barrel = 537.61 cubic feet
Mississippi sack = 1.98 cubic feet
Texas barrel = 3 boxes (1 box = 10in x 20in x 13.5in) = 675 cubic feet

* Texas has a $120 individual commercial fisherman license but very few if any sold

Table 3: Miscellaneous state shellfish management program notes.

	Percent Public Acreage	Percent Lease Acreage	Shell Recycling Program	Shell Owed to State	State Replant	Area of Aquaculture
Alabama	100	0*	Dep. Of Conservation	none required	approximately every 3 years with tag funds	within lease
Florida	73 ***	27	Dep. Of Agriculture	50% shucked shell to dept.	250,000 bu. on public beds	high density lease areas
Georgia	38	62	U of GA developing	none required	none at this time	within lease
Louisiana	80 **	20	investigated	none required	small amount when funds available	not in lease - no oyster mariculture at this time
Maryland	97 **	3 **	MDDNR	none required	1 million bu. dredged; 100,000 bu. Fresh	bottom culture within lease
Mississippi	95	5	DMR	none required	average over 110 acres/year - use contractors	bottom culture within lease without permit
North Carolina	99	1	Div. Of Marine Fisheries	none required	200,000-300,000 bu. on public beds	within lease with permit
South Carolina	79 **	21	SCDNR	none required	28,661 bu. on public beds (2003)	within lease or public grounds
Texas	89	11	considering	all owned by state	none at this time	not in lease
Virginia	71 **	29 **	VA DEP/VIMS	20% shucked shell sold to dept.	public beds as funding will allow	within lease in less than 1 ft. from bottom

* no leased state bottoms since 1980's
** not all acreage productive
*** in Apalachicola Bay, other beds not surveyed

Appendix 2: Resource Manager Meeting Notes

Gulf and South Atlantic States Shellfish Conference
20 April 2004, Jekyll Island, GA

North Carolina

Public Grounds: North Carolina plants about 200,000 to 300,000 bushels of cultch per year on common resource areas. The most common and preferred cultch is Gulf shell from shucking plants in North Carolina, but competition and escalating prices are increasing the amount of #4 marine limestone marl (septic tank rock) and surf clam shell used. Recently, competition for surf clam shell is also reducing the amount available. The state has a number of barges and boats as well as a front-end loader and high-pressure hose for planting, but few personnel. Personnel shortages are problems especially when trying to expand the program. Currently all deployment on public bottoms is done by the State Shellfish Rehabilitation Program and is not contracted out. Public meetings are held in coastal areas to solicit input on cultch planting sites annually in the spring. Funding for cultch planting on public bottoms is through state appropriations. Cultch material must be approved by the N.C. Division of Coastal Management and Division of Water Quality and is currently limited to oyster shell, scallop shell, surf clam shell, and fossil stone (marine limestone marl).

Private Grounds: Planting and cultivation are required on lease areas in North Carolina. Lease owners are required to plant either 25 bushels of seed per acre or 50 bushels of cultch per acre or a combination of both that will equal 100% (i.e. 12.5 bus. of seed and 25 bus. of cultch). The leaseholder must also produce and sell with a trip ticket verifying a minimum commercial sale of 10 bushels of shellfish per acre per year. Leases are still a contentious issue in North Carolina due to leased areas being removed from the use of the public for shellfish harvest. Other uses can continue unless the activities will damage the product or structures being used by leaseholders. Rental fee money is relatively insignificant at $5/acre/year.

Shell Recycling: The Oyster Shell Recycling Project in North Carolina is one year old and was modeled somewhat after the South Carolina program. The project is trying to recruit volunteer area coordinators that can organize activities in their area. These coordinators stockpile shell from oyster bars and shucking houses in trailers throughout the state. Overall coordination and movement of large volumes of shell is done by the Division of Marine Fisheries. Limited funding from the Shellfish Rehabilitation Program has been used to jump start the project. Partners have been recruited (The Nature Conservancy, N.C. Coastal Federation, Cape Fear River Watch, Pamlico -Tar River Foundation) and cooperative efforts to expand the project and procure funding through grants are off-season priorities. Due to the cooperation of the partnering groups and their interest in the recovery of the oyster population, recycled shell will be targeted for deployment in an area as close to the recycling area as possible and be used primarily for research projects or no-take sanctuaries. N.C. has also initiated research into the construction and siting of a series of no-take oyster sanctuaries. The purpose of these sanctuaries is to allow unmolested natural selection to provide a robust native brood stock to provide increased larvae and spatset. Competition for oyster and surf clam shell is one

of the greatest obstacles since these materials routinely provide better recruitment than the marl. Oyster recruitment and survival are being impacted by water quality and disease, and habitat destruction on heavily impacted populations are issues presently of top priority.

Georgia

Public Grounds: In the late 1980s and early 1990s Georgia tried to restore public harvest areas, however, subsequent budget cuts limited the ability of the program. Presently, the Georgia Department of Natural Resources (GADNR) has begun a pilot project to restore oyster beds by assisting the University of Georgia in an oyster recycling program similar to that in South Carolina. Depending on the success of the program, recycling efforts may continue through either the University of Georgia or GADNR after the duration of the pilot project. The University obtained the permit from GADNR necessary to put shell on shellfish bottoms. GADNR designates sites that have potential to be recreational harvest areas and uses these as restoration areas for the recycling program cultch material. State equipment owned by the University is used for planting. The state does not contract planting, but has begun contracting the fecal coliform lab work. The project with University of Georgia has just begun and so there is not yet an idea of the costs or number of bushels planted each year, however, it has already been successful from a community participation perspective. Georgia also holds shell for three months before planting in state waters, and is currently not using any material other than oyster shell for cultch. Money for this program is funded through a grant from NOAA and assistance from Ocean Trust.

Private Grounds: Georgia has 15 commercial lease areas. Nine are on privately owned water bottoms (Crown Grants) and six are on state water bottoms. Leases average 500 acres in size but range from 25 acres up to 1500 acres with an average fee of $1 per acre. In most cases, leases include water bottoms capable of producing shellfish, as well as adjacent marsh and upland property. All shellfish harvest in Georgia occurs intertidally and includes wild harvest and mariculture activities. Leaseholders harvesting oysters are required to plant 33.3% of their harvest in cultch material back onto the lease area. Cultch can include a number of materials, including oyster shell, whelk shell, flattened crab traps, oak limbs and bedsprings. Money from shellfish lease fees is added into the fees from marinas and distributed as water bottoms lease funds. Historically marinas got most of the funds for BMPs, however, for the last three years, the shellfish program has received most of the money. This is not a large sum and is generally given to University of Georgia for research since the GADNR does not have its own research wing. These funds have been recently used to develop raceway and tidal upweller systems to promote clam farming.

Shell Recycling: The program run by University of Georgia explained above is the recycling program in the state.

Florida

Public Grounds: Florida cultivates common areas where both commercial and recreational harvest is allowed. This cultivation involves planting shell and transplanting operations (from intertidal to subtidal areas). Four to five state employees are dedicated to shell planting and only state equipment is used. Money for planting operations is

obtained from the general revenue fund, licenses and surcharges. User fees provide a portion of the funding ($100,000 @ $100/yr/license). There is a $0.50 surcharge to the first processor per bushel of oysters sold, which provides about $35,000/yr, but this law is poorly enforced. On average, about $500,000 is spent each year to plant and cultivate public areas.

Relay and transplant projects are contracted out to the industry. Most relay/transplant projects are conducted in waters from Suwannee Sound to Apalachicola Bay. About $404,000 is spent annually for relaying and transplanting projects to restore public oyster reefs. About $104,000 from license fees and $350,000 from the general revenue is allocated for these resource and economic development programs. Presently, the majority of this money is spent on relaying projects that are conducted by commercial oystermen who participate in these cooperative programs. Most oyster resource development programs are conducted during periods when the oyster harvesting season is closed or when waters are temporarily closed for public health purposes to offset economic hardships related to the closures. There are 4-5 employees who manage these programs and more than 100 oystermen and their families who participate in individual projects.

Oyster shell and calico scallop shell are used as cultch. Scallop and oyster shell are collected locally, as by-products of processing. Although oyster shell is primarily collected from processors located near Apalachicola Bay, the majority of the shucked shell originates in Texas and Louisiana. By law, 50% of the shell processed in the state belongs to the state, but the shell collection program is operated exclusively on a voluntary basis. In recent years, competition for the shell has increased and voluntary contributions have diminished, placing the planting program in jeopardy because of the lack of cultch material to plant. Florida is looking into alternative approaches to obtain shell, including purchasing shell from processors. Likewise, the state is seeking alternative sources of funding, including grants, mitigation funds, and Congressional appropriations.

During FY 2002/2003, 81,134 bushels were collected, and 340,368 bushels of shell were planted on public reefs. The majority of shell planting is conducted in Apalachicola Bay, with only minor projects in other Gulf coast bays and estuaries. Production from most restored reefs is variable; however, increased production is anticipated for five to ten years. Resource managers may also drag restored reefs using equipment designed to re-expose buried shell and to remove sediments. This activity may also extend the productive phase of restored reefs.

Private Grounds: Currently, there are two administrative leasing systems in Florida, shellfish leases and aquaculture leases. There are about 20 historical oyster leases (shellfish leases) accounting for about 1000 acres. Most leases support little production, other than those located in Apalachicola Bay where production is good. In 1989 a new lease system was put in place to accommodate increasing opportunities for aquacultural activities. There are presently 670 leases accounting for about 1,600 acres, however, the vast majority of this acreage is dedicated to hard clam production. Rental fees go to a trust fund, which is used for program administration and management. New leases have an application fee ($200.00) that is used to pay for a site assessment. Annual lease fees are $16/acre with a $10/acre surcharge. The surcharge is used in lieu of a performance bond to clear abandoned leases.

Shell Recycling: The Department of Agriculture and Consumer Services, Division of Aquaculture runs the shell recycling program in Florida. Shell is recycled from the major shucking houses in Apalachicola Bay, but shell is not recycled by wholesalers or the public. Money to support this program comes from general funds and legislative allocations, which are used to meet a goal of 250,000 bushels planted each year. Only public beds in approved or conditionally approved waters are planted, but if shell was supplied the state would consider planting leases. Cultch availability is a problem, since shell is only collected from processing plants. Competition for material has increased and voluntary contributions are decreasing. Some shell is purchased (buy-back program) for special projects and costs about $12.25/bushel.

Alabama

Public Grounds: The state beds in Alabama are cultivated using private contractors. The amount spent and bushels planted vary according to funds, which come from oyster sack tag fees and federal disaster relief funds.

Private Grounds: Alabama has not leased state bottoms since the 1980's, but does allow property owners to file for harvest and cultivation riparian rights on land up to 600 yards from their waterfront if no natural resource exists. The property owner may allow others to harvest on this area, but must provide the department with the names of harvesters.

Shell Recycling: There is presently no shell recycling program in Alabama.

Mississippi

Public Grounds: Harvest areas in Mississippi are cultivated by relay and replanting of shell and only public areas are cultivated by the state. The state owns a dump truck, front end loader and 65 ft. boat, which are used for small plants, but larger plants are contracted out with a vendor. Competitive bidding is used and the vendor is in charge of all aspects of the planting except permit requirements, which are done by the Department of Marine Resources (DMR). Previously this involved the contractor supplying, moving and deploying shell or other approved cultch material on the beds. This costs the state about $24.50 per cubic yard planted, down from $32.50 per cubic yard planted in 1999. In 2004 MSDMR bought shell and contracted out the moving and deployment at a cost of $26. Oyster shell, clam (*Rangia*) shell, crushed concrete, and crushed limestone (57grade) can be used on public beds. Ideally, MSDMR would like a combination of both single and cluster oysters, but usually whole shell material is planted because MSDMR prefers this material. There are not many recreational harvesters in Mississippi and all harvest is done by dredge or tong.

Replanting is funded by federal and private grants. In addition, a fee of 15 cents is charged to each harvester and first dealer per sack sold/bought to be used for planting funds. The goal of the program is to use state money as a match for other funds. Approximately 125 acres per year are planted. To plant one shell thick on a bare bottom, 100 cubic yards of shell are needed per acre. Some areas are double planted and the thickness of planting differs depending on whether dredges or tongs will be used on that bed.

Private Grounds: There are six active leases in Mississippi with a total average of about 450 acres. There is a minimum $1/acre annual fee but this money is insignificant

for management funds. Leases are difficult to manage and are more problematic than the public bed commercial program. Cultivation is required by leaseholders and can include planting or moving oysters from restricted waters to leases during a 2-3 week time period.

Shell Recycling: There is no shell recycling program in Mississippi; however it has been talked about. The state is considering encouraging harvesters to put shell back on designated reefs not presently open for harvest, but is unsure how successful that will be.

Louisiana

Public Grounds: There are approximately two million acres of public grounds in Louisiana with roughly 20% of that acreage covered in reef. Nearly all reefs are subtidal and public grounds are replanted when funds are available. Crushed oyster shell, crushed concrete and small pieces of limestone (#57 grade) are used to promote growth of single oysters. The management goal for public grounds is to provide "seed" oysters (< 3") for replanting onto lease areas. In the past, 80% of the harvest was from lease areas, but for the past several years public areas have been so productive that the industry has shifted its harvest effort and now the harvest from lease and public areas is split evenly. There is no requirement for leaseholders to replant leases and there is no special public ground harvest license. Some leaseholders are trying to get new legislation requiring licenses, but have not yet been successful. To obtain a gear permit, it is necessary to have a commercial harvest permit. Recreational harvest is not common since it is limited to two sacks of hand picked oysters and nearly all beds are subtidal.

Historically, replanting has been contracted to private industry; however, the state is now trying to do some planting of its own. State equipment includes barges, draglines and a tug. Current contracts range from $30-69 per cubic yard because companies sometimes write liability into contracts of crossing over leased acreage. Shell is difficult to obtain because most oysters are shipped out of state and plain shell can be sold easily. Presently the state can only buy half of the shell in the state because sellers have other markets for the shell. Money for planting usually comes from federal funds, with the most recent funding coming from a hurricane disaster grant and a coastal impact assistance grant. Previously, general state funds could also be used, but that money is no longer available. An additional source may come from compensation for water bottoms damaged from construction and oil/gas activities. There are also a few proposals for coastal restoration to develop reefs as shoreline protection and use of oil spill restoration funds to build reefs. These projects will likely occur on public grounds and in polluted waters so that harvest would be restricted.

Private Grounds: In Louisiana, lease and public areas are managed separately. There is presently a moratorium on new leases due to a number of lawsuits by some leaseholders against the state. About 400,000 acres are under lease, but not all are producing shellfish and many are closed to harvest for water quality reasons. There used to be a 10% cultivation requirement, however, this law changed three years ago to no required cultivation. There is an annual fee of $2/acre and although there is a maximum acreage one person can own (2500 acres), many people hold leases in other people's names so they have more than 2500 acres total. Leases are a contentious issue and some leases may be used for speculation more than for cultivation. Leaseholders can obtain

fees from oil/gas companies for bottom disturbance impacts, although the companies do not have to pay the state to cross public grounds unless water bottom damage occurs. Because so much land is under lease the fees add up to a reasonable sum. This money is used to run the oyster lease survey section and the rest is put into the general fund.

Shell Recycling: Louisiana is investigating the possibility of a shell recycling program in the state. A feasibility program funded by NOAA was completed to look at the possibility of a recycling program and whether it would be valuable to the state. Planting is logistically difficult in Louisiana because of the coastline and this must be taken into account. It may be possible to concentrate on restaurants in New Orleans. However, these are small amounts of shell in a number of places and logistically it would be more feasible to collect from shucking houses. Presently the larger shucking houses will only sell half of their shell to the state. A pilot program will likely be run in the next few years to determine feasibility. Likely, parishes (i.e. counties) will be responsible for bringing shell to staging sites and the state will use state equipment to move the shell to the deposition site. Presently getting cultch is the biggest problem because of the purchase price and reduced availability; however, community pride may help to start the shell recycling program by copying a similar community-involvement project called the Christmas tree recycling program.

Texas

Public Grounds: Texas does not cultivate common resource areas and does not allow alternative cultivation on public grounds.

Private Grounds: Texas presently has a moratorium on new lease areas. Revenue from existing lease rental fees is used for operational and administrative functions. The oyster lease program in Texas is based solely on relay of oysters from restricted waters and depuration. Relaying from leases is used to reduce the population of oysters occurring in restricted waters to minimize the potential for poaching and to allow use of a resource that would otherwise be wasted. Oysters can only be transplanted to leases from restricted waters (as determined by Texas Department of Health) and only during restricted seasons. Texas Parks & Wildlife issues transplant permits for this activity. Typically, leaseholders transplant 9-12 days in May-June and 8-10 days in September-October.

Shell Recycling: Texas does not presently have a shell recycling program; however, discussions are taking place with industry about the feasibility of developing a shell recovery and oyster reef construction/enhancement program. Oyster shell belongs to the state and Texas Parks & Wildlife Commission has the authority to establish and conduct programs to require the recovery and replacement of oyster shell in the coastal waters of the state. Should a program be developed, placement of cultch material would have to be in public waters, since the Oyster Fishery Management Plan does not promote the development of reefs in restricted waters.

Other Subjects Discussed

Oil Spill Damage: The price assigned to damaged beds from oil spills varies by state. In Louisiana and Florida a specific price is assigned per square foot of bed damaged. The price is assigned by habitat loss, not by opportunity loss of recreational

harvesters. It is difficult to use socioeconomic data but this may be done in the future by NOAA's restoration center.

Sanctuaries: In Florida and Mississippi, officials in National Estuarine Research Reserves are interested in putting oyster reefs into degraded water quality areas as a habitat enhancement technique. There are presently four high relief sanctuaries in North Carolina, used as spawning sanctuaries and are off limits to harvest.

Future Ideas: Cooperative effort to obtain grants from federal, state and local sources in order to buy cultch for planting operations.

Table 1: Public Shellfish Ground Planting

State	*State equipment*	*Total planted*	*Total spent*	*Funding source*
Alabama	no	varies	varies	sack tag fees, federal funds
Florida	yes (planting)	81,134 bu. (FY 2002-03)	$500,000 planting; $404,000 relay	general revenue, licenses, surcharges
Georgia	yes (university owned)	n/a (new program)	n/a (new program)	NOAA grant, Ocean Trust
Louisiana	yes (some plants)	540,000 bu. (FY 2003-04)	varies - $2 million in 2002-03	federal funds
Mississippi	yes (small plants)	270,000 bu. (FY 2003-04)	varies - $350,000 in 2003-04	shell retention fees, grants
North Carolina	yes	200,000-300,000 bu.	$762,000 in 2003-04	state appropriations
South Carolina	yes (moving/loading shell)	30,000 bu.	$100,000	recreational fishing license
Texas	n/a	n/a	n/a	n/a

Table 2: Private Shellfish Grounds

State	*Fee/Acre*	*Rental fee use*	*Planting requirements*	*Alternative cultivation*
Alabama	property owner	n/a	no requirement	limestone
Florida	$15.95/acre, $10 surcharge	administration, management	no requirement	calico scallops
Georgia	dependent on sale	U of GA research	33.33% of harvest	not allowed
Louisiana	$2	lease survey, general fund	no requirement	crushed concrete and limestone
Mississippi	more than $1	insignificant	cultivate, plant or harvest	crushed concrete and limestone, clam shell
North Carolina	$5	insignificant	25 bu. seed or 50 bu. cultch /acre/yr.	scallop and surf clam shell, limestone marl
South Carolina	$5	general fund	50 bu./acre/yr	whelk shell, bamboo, stakes
Texas	$6	operation, administration	no requirement	not allowed

Table 3: Shell Recycling

State	*Shell recycling program*	*Recycling funds*	*Amount of plants*	*Type of beds*
Alabama	no	n/a	n/a	n/a
Florida	yes - Dept. of Agriculture	general funds, legislative appropriations	250,000 bu./yr	public A, CA*
Georgia	yes - U of GA	NOAA grant, Ocean Trust	n/a (new program)	recreational harvest potential
Louisiana	investigating	n/a	n/a	n/a
Mississippi	no	n/a	n/a	n/a
North Carolina	yes	rehabilitation program and grants	n/a (new program)	research, sanctuaries
South Carolina	yes - SCDNR	recreational fishing license	30,000 bu./yr	public A, CA, R*
Texas	investigating	n/a	n/a	public A*

* A – Approved waters; CA – Conditionally Approved waters; R – Restricted waters

Table 4: Fee Structure

State	*Commercial permit*	*Recreational permit*	*Fees/permits*	*Fees/permits*	*State tax/bag fee*
Alabama	$26	no license	n/a	n/a	$0.25 per tag
Florida	$50, $100 for App. Bay	$13.50	$50 aquaculture certificate	$100 commercial vessel	$1/bag in App. Bay
Georgia	$12	$9	shellfish picker stamp free	n/a	no fee
Louisiana	$55	$6	$100 oyster captain, $15 vessel	2.5-3 cents per barrel	15-45 cents per tag
Mississippi	$100 dredge, $50 tong	$10	possible wetlands permit fee	boat fee	$0.15 per sack harvester and dealer
North Carolina	$200 standard or $25 shellfish only	$35	shellfish endorsement free	aquaculture permit free	no fee
South Carolina	$25	$10	$75 state grounds harvester	mariculture permits required	no fee
Texas	$30 boat captain	$23 licence + $10 saltwater	$420 commercial oyster boat	$12 sport boat	$1/barrel

Appendix 3: Staff Interview Responses

Success and Shortcomings

Staff members were asked their opinion on the major success and major shortcoming of the present state laws governing shellfish harvest. The overall perception of management was positive citing flexibility in laws, clear separation of the two agencies while maintaining resource protection, a good working relationship with industry, DHEC's record of keeping polluted shellfish out of the market, success in court, and a strong lease (culture permit) system as success points. The most commonly noted success (four responses) was the increased availability to harvest through the State Shellfish Grounds (SSG). This increased availability was also noted as a shortcoming, as well as the number of closed areas and lack of enhancement (shellfish husbandry and planting) in these areas, the low planting requirement on Culture Permits (CP), the separation of DHEC and DNR point systems for law enforcement, and the lack of new areas to form CPs. However, the most common shortcoming cited, with eight of the eleven interviewed in agreement, is a lack of funding for SSGs.

Generally, most staff felt that the 1986 law changes increasing the number of common resource areas and beginning SSGs was a positive change, but agreed that the lack of appropriations with this law change makes it difficult to properly manage SSGs. The overall feeling was that DNR has learned how to work within the laws they have and resolve issues as they arise. Most feel that the laws are relatively complete and that weaknesses are more a result of whether the laws are adhered to and enforced. It was noted that the value of oysters outside commercial interests is not considered in the present laws and with decreased industry value should be considered more. It was also stated that since there are not enough people involved in the commercial industry to affect legislation, the management of the resource is underfunded.

State of Resource

Staff members were asked whether they felt the quality of the resource had improved, remained the same or declined over the past 10 years and what they felt the reason to be for that change. They were also asked what they felt had the biggest impact on harvest levels. Most felt that there are fluctuations between areas and that cycles do exist. The majority (seven out of nine) felt that the quality/condition of the shellfish has stayed constant or slightly improved. However, they felt that the quantity/production had decreased or stayed the same (six out of eight). Two staff felt that very recently, within the past two or three years, the resource has been improving in both quality and quantity. Staff attributed decreasing quality and production to the diminished state of the industry, poor harvesting techniques, improper SSG management, and declining environmental conditions. Those who felt the production was increasing cited improved health of the resource with fewer die-offs. Most staff felt that harvest levels were dependent on environmental conditions or human impacts on the environment with three citing water quality and pollution impacts, and three citing boat wake impacts. Other staff felt that bed usage had the most impact on harvest with two noting the strength of the industry/size of labor force, two noting type of harvesting technique and one noting an improvement in management.

SCDNR Performance

Staff were asked what they felt SCDNR's primary responsibility was and whether they were satisfied with the department's performance. Since the department must administer laws that both protect the resource and support harvest, there are bound to be different opinions on which aspect is more important. Two staff members felt that the department's two responsibilities were equally important, while four felt that maintaining the resource was more important than the consumptive value, and one felt that insuring maximum yield for harvest was more important. One staff member felt that it was most important to protect the resource for the future by using it wisely now, and one felt that issuing licenses and managing CPs and SSGs was the department's primary responsibility. The difference between management and research efforts within DNR were either directly mentioned or indirectly referenced by a number of staff, with issues of information exchange, cooperation and communication being problems.

When asked whether they were satisfied or dissatisfied with SCDNR, nearly all responded relative to their lack of funds. Most noted dissatisfaction in that the department cannot work effectively with the existing budget. They felt that appropriation changes had hurt their ability to be successful and more could be done with increased funds and personnel. Other respondents also felt that the department has more recently headed in the right direction, but needs to broaden its view of the resource value.

Staff members were lastly asked specifically where more effort should be focused. All felt there should be more effort put into replanting, specifically with increased equipment and personnel. A few noted that replanting commercial grounds needs to be considered, and a way to do so should be investigated. Four people felt there should be more law enforcement and three felt that the amount of law enforcement is adequate. When considering administration, five felt there should be more staff to return the department to the level seen previously, one said there was enough staff, and two felt there should be fewer. All who felt there should be more staff would like to see them in assessment, monitoring and replanting, not in higher management. Those who felt there should be fewer staff referred to the department having too many managers, and the need for staff restructuring so more are in the field. Additional areas for increased effort include stock health, cooperation with industry, and signage on CPs and SSGs. One respondent noted that it is difficult getting laws passed through the legislature fast enough to be relevant to the present industry situation. The department needs to be able to adjust to conditions in a more rapid manner to properly manage the resource.

SCDHEC Performance

Staff was also asked about what they felt SCDHEC's primary responsibility was and whether they were satisfied with the department's performance. Nine of the eleven people interviewed said that public health and prevention of disease was the top priority, with one person feeling the restoration of shellfish area water quality should be the top priority. Four additional people stated water quality restoration is a second priority after human health. Almost all the people interviewed were satisfied with SCDHEC's performance; although two felt that more effort should be put into water quality and habitat restoration. Some of the people interviewed felt that while public health should be SCDHEC's only concern, it was being pushed into other areas because of the lack of resources at SCDNR.

There were a number of responses when asked what could be done to improve the performance of SCDHEC. Two people said improving the communication process following bed closures, possibly with a toll free number for harvesters to call, and two people said improving signage of closed beds, with either more signs or arrows on the signs indicating where closed beds occur. Additional suggestions included more flexibility in harvest from restricted and conditional beds, a new standard for water quality, being more proactive in the National Shellfish Sanitation Program, finding why areas are being closed and working to fix water quality there, giving equal rank and pay for law enforcement as compared to SCDNR law enforcement, conducting more meat sample tests instead of only water samples, and digitizing records so shellfish can be tracked more efficiently. Problems following product through retail was discussed as a major issue since SCDHEC officers can no longer control product in retail facilities. It was also mentioned that SCDHEC had very little control over non-coastal retail and transportation since shellfish health information is limited beyond coastal areas. All interviewed felt that Shellfish Sanitation was working to the best of their ability, but would like to see these areas investigated and increased funding afforded the department.

Management of Culture Permits

When asked how the department was handling commercial harvest, specifically concerning CPs, staff felt that overall SCDNR was doing a good job maintaining the beds. Most respondents felt that the department was working well under the budget and personnel constraints placed upon them. There were a number of suggestions for improving management of CPs, with three people suggesting reducing the acreage for large CP areas to allow for either more CPs or more SSGs. A number of people also were concerned with the ability of CP holders to work on SSGs rather than using the CP grounds, and one person suggested requiring a level of harvest on CPs to curb this practice. However, as stated by another respondent there is a great deal of variability between CPs, most of which they felt could not be controlled, and so it would be difficult to make a harvest requirement. A respondent suggested allowing individual harvesters onto CPs for a specified amount of time if not being harvested properly to allow for a required harvest limit to be met. This would be administratively difficult, but possible. A de-emphasis on the commercial fishery was noted by one respondent who felt more effort should be extended to improve quality and quantity of the harvest.

When asked about whether fees should be increased, five responded that they should and four that they should not. Those that felt the fees should not be increased believed that budget issues needed to be handled another way because increasing fees would be detrimental to the commercial industry, which is already slipping. They also felt that since the department does not retain all of the funds from tickets and permits, an increase in the fees would not help management of the beds. They felt that the fee should not be increased unless it is set aside specifically for shellfish management. Those that felt the fees should be increased were unsure if it was possible politically, but felt it would increase the appreciation for the beds if they were worth more. Nearly all staff agreed that the SSG harvest license (currently $75) should also be increased, especially since they do not have any planting requirements and most of the cost of a CP is the planting.

When asked about the planting requirement and if it should be increased, four people responded no and two responded yes. The unavailability of shell was the main concern with requiring an increase in planting. It was mentioned that the ownership of shell or a bag tax should be re-explored in an attempt to deal with the availability of shell. The issue of SCDNR granting variances for planting shell, which allows CP holders to use alternative methods to meet their planting requirement, was spoken of by many staff. Some felt variance application was a good process because it allowed flexibility in the system. A number of people, however, thought this allowance made it easier for less shell to be planted and more enforcement of shell planting to meet the planting requirement is needed. Three people felt that fewer variances should be given and the department should be less lenient on allowing CP holders to not plant shell. When asked about alternative planting as a whole many felt it is appropriate as a supplement to planting, but that there are some conditions in which only shell will work. The type of alternative planting had an impact on whether the respondent felt it was worthwhile. Relaying seed oysters was suggested by two staff as an option for alternative planting that is underused. It was stated that raking (breaking up high density clusters of oysters) does not provide for more oysters, even if it produces better marketable oysters and therefore should not be allowed as a variance for planting. In addition, while it was felt by many people that stakes to catch oyster spat are successful, it was doubted whether they are restoring habitat. Alternative planting was stated as being valuable from a compliance standpoint, as well as providing the ability to try various techniques to determine if some methods are cost efficient in the long run. It should be scrutinized, however, because cost savings are meaningless if the planting is not effective.

Management of Mariculture Areas

Staff were also asked to comment on the management of hard clam mariculture areas in the state. Most felt that the department was handling mariculture areas well and had an appropriate level of flexibility to respond to new changes in the industry. They felt it will be a test of management abilities as the industry continues to grow. A few people commented that the lack of a requirement that farm gate landings be reported is a problem, and feel this needs to be changed. There were a number of suggestions for improving the department's handling of mariculture. None felt that the department should necessarily promote mariculture, but it should provide more information on starting a mariculture venture since it is difficult and expensive. With the growth in the industry, more areas will be needed for new mariculture sites, and clam seed importation will need to be controlled with enforceable policies. There is a need to develop a set of responses to possible problems, such as user conflicts, so issues can be handled efficiently and unbiased if the need arises.

Management of State Shellfish Grounds

State Shellfish Grounds (SSGs) are considered by all staff to be in much worse shape than CPs. Many respondents had previously noted that it is important to work oyster beds to keep them in harvestable condition; however, they stated that SSGs are being harvested far beyond the basic level of husbandry. They felt SSGs are being overharvested so quickly that replanting cannot renew the resource. It was stated by one respondent that although the department has an obligation to provide a reasonable return

from the state beds, they also have an obligation to control harvest when it is being detrimental to the beds. Although harvest levels have stayed relatively stable over the last few years, it was noted by a respondent that we have no information on catch per unit effort (CPUE), which may be decreasing, indicating a declining resource. One respondent is not sure the loss of resource in SSGs is all due to harvesting and believes there may be other factors discouraging recovery. Others felt that regardless of the cause, SSGs are not being kept closed long enough for recovery.

After being asked generally about SSGs, staff was asked what they felt to be the most feasible way to control heavy harvesting in public areas. Most respondents (nine out of eleven) mentioned the importance of replanting areas when asked how to improve SSG management. It was generally agreed replanting in Public Shellfish Grounds (PSGs) has been successful, but that the SSGs are receiving most of the harvest, and are not being replanted. While the staff understood the political and financial reasoning behind this, they felt it was not logical, and replanting should be extended to SSGs. It was noted that some beds could be kept healthy with the rotation schedule if they were just replanted periodically to get growth started. Planting in these areas was noted as being as much or more important than the rotation schedule for restoring habitat and keeping the harvest sustainable. Funding replanting efforts was also a common issue discussed. Two people stated that an annual funding source is needed because the existing resources are not adequate to provide proper management. It was also suggested that the state needs to fund the husbandry of SSGs, or put the acreage back into CPs and allow permit holders to fund their husbandry. A shell tax or shell recovery effort, which would consist of having wholesalers charge an extra fee per bushel and having the fee returned if shell was returned, was suggested. One respondent suggested looking into federal grants for buying shell. Planting requirements for independent harvesters was also suggested, however, a number of respondents felt this would not be feasible because of the difficulty and equipment needed for replanting. Expansion of the recycling program was mentioned as a way to obtain more shell without increased funding to be used for the purchase of shell. It was also suggested that vendors be involved in encouraging recycling by giving coupons for returned shell.

A number of suggestions were made for handling the heavy harvest on SSGs and are listed below.

- Three people noted the need to restrict CP holders that use SSGs first and wait to harvest their permits until after the public areas have been heavily harvested.
- One respondent suggested a hybrid CP/SSG where CPs were open to the general public, but they must pay for harvest. This price would be relative to shellfish prices, or sale could be made directly to the CP owner.
- Two people also noted that the harvest effort/acre on the SSGs is higher than anywhere else and needs to be spread over more available acreage, either by using unused areas in CPs, rotating commercial harvest occasionally into PSGs, or increasing overall SSG acreage. Two respondents felt that a longer rotation time was needed, one suggesting a gradual increase in the number and size allowing three sets of areas alternatively opened, however, another respondent did not feel enough area could be designated to allow proper recovery during rotations.

- While three people felt that limiting the number of people allowed on specific SSGs would be beneficial, especially if compared to limiting the amount of commercial harvest allowed daily, three other respondents felt limiting harvest by individuals or landings would not be feasible and administratively costly. One person suggested simply putting a cap on the number of permits given out each season regardless of the SSG used, and one person suggested simply expanding the lottery for a state ground as done for Parris Island presently.
- Two respondents suggested a size limit or a daily limit allowing for a smaller percentage of the harvest to be dead shell, in order to encourage cull in place. The size range may need to be dictated by the department since oysters do not grow uniformly each season.
- It was also suggested that recreational harvest should be eliminated from some areas, just as commercial harvest is presently limited until the impact of recreational harvest is understood. One respondent pointed out that when commercial harvest is closed on an SSG, recreational harvest is still allowed. This, the respondent said, seems to hurt the purpose of stopping harvest to allow recovery. Another respondent noted that since the department does not have a good understanding of the level of public harvest, recreational impacts might be more than anticipated and should be reviewed.

Management of Recreational Harvest

When asked about how the recreational fishery is managed, most respondents were positive, but had suggestions for improvement. Respondents were first asked whether there should be more recreational harvest areas, or if the present number is adequate. While seven people felt the number was adequate, only two suggested there should be more areas. Three people said that unless there was more funding to support replanting there was no reason to make more recreational harvest areas. One respondent said specifically that there needed to be more recreational areas in the northern part of the state. Three people felt there needs to be more information made available on the location of recreational harvest areas. The respondents felt that few in the public knew that recreational harvest is allowed on SSGs. Better signage of these areas, and pertinent information when purchasing a saltwater stamp were two suggestions for increasing the public knowledge base. One respondent felt that more SSGs need to be accessible by foot. It was also stated that recreational areas are generally underutilized and that if commercial harvest was controlled, both should be allowed on all public beds.

Management Framework

One of the purposes of the staff interviews was to determine how well the management framework between SCDHEC and SCDNR was working. Seven of the eleven felt that the present management structure was helpful and it was either useful or important to keep two separate agencies. It was felt that this framework permitted the agencies to focus on two different aspects of the resource (i.e. public health, resource management) and allowed for built in protection. It was mentioned that while there is no problem at a working level, it is difficult dealing with two different chains of command before agreeing on an action. Staff who mentioned combining the two agencies felt that it would fix this problem, but that shellfish law enforcement should be designated as a

distinct group within DNR law enforcement to keep from diluting the effectiveness of the position with other duties.

The positive aspects of the present framework were based on good cooperation at the working level between DNR and DHEC's shellfish sections. Six respondents said there was little or no communication problems and four stated that the communication is much better than it used to be. Much of the increased communication is facilitated by quarterly meetings, which allow discussion of issues or disagreements. It was stated that cooperation is not as evident higher up in the two agencies; however, at the lower levels communication is positive. When problems do arise, it is generally during weekends or on Friday afternoons when it is difficult to contact people within the other agency. A continuing problem noted by a few respondents was the bed closure notification process, which could be more efficient. It was also noted by a respondent that housing the two agencies together might fix some of the small communication problems.

When asked about what areas are either redundant or overlooked by having two agencies, staff felt that overall the two agencies have done a good job covering all aspects of the resource. The overlap of law enforcement patrols was mentioned by three respondents as a good aspect. Areas mentioned by staff that should be addressed because they are overlooked are invasive species, prevention of activities that affect water quality on shellfish beds, and public advocacy. It was also noted that the law enforcement point system should be combined and the DHEC tagging and DNR statistic systems should be combined.

Additional Comments

Additional comments by respondents that did not necessarily fit into one of the preliminary categories for discussion ranged over many topics. Two respondents mentioned a need for marketing of South Carolina product in the form of recipe booklets, key rings, calendars, and so forth as is seen in other states. Another respondent mentioned marketing issues when he commented that it was a good trend for local restaurants to be putting an emphasis on serving local oysters. Another idea for renewing interest in local shellfish is a small scale shucking facility used for tourism purposes and as a way to promote the usefulness of shell recycling.

Questions used to guide staff interview discussion

1) What do you feel is the major success and major shortcoming of the present laws governing shellfish harvest? Do you feel the resource is better off after the 1986 legislation, or are there aspects of that law change that you feel are problematic?

2) Over the past 10 years do you think the quality of the state oyster resource has improved, remained the same, or declined? What do you believe to be the reason? What do you think has the biggest impacts on harvest levels?

3) What do you believe to be the primary responsibility of SCDNR? Are you satisfied or dissatisfies with DNR's performance in meeting these? Why? Do you think SCDNR should direct more, the same, or less effort into administration? Law enforcement? Replanting? Other?

4) What do you believe to be the primary responsibility of SCDHEC? Are you satisfied or dissatisfied with DHEC's performance in meeting these? Why? In what areas do you feel the department needs to improve? Are there specific ways that management could be facilitated? Do you believe the DHEC shellfish controls effectively keep tainted shellfish off the market?

5) What is your opinion regarding the management of culture permits? Do you feel shell planting requirement and CP rent is appropriate, too low, or too high? Do you feel that alternative planting techniques are as valuable as laying shell? If so, what type of alternative planting techniques?

6) What is your opinion regarding the management of mariculture areas? Should the DNR direct more, the same, or less effort into promoting mariculture?

7) How well do you feel the SSG's are being managed? PSGs? What do you feel is the most feasible way to control heavy harvesting in public areas? Do you believe that decreasing the harvest allowed on these beds will sustain the resource, or will planting be necessary? Should alternative planting be encouraged as a way to decrease planting costs?

8) What is your opinion of the recreational fishery? Should there be more recreational harvest areas, or do you feel the number at present is adequate?

9) Do you feel the existence of two agencies governing different aspects of the shellfish resource is helpful or problematic? Do you feel that combining the agencies would benefit management? Do you notice a problem with communication between the two agencies?

10) Do you feel that there are aspects of the resource that are not being addressed by either agency? Do you feel that there are management aspects that are redundant or being dealt with by both agencies in different ways?

Appendix 4: **Industry Interview Responses**

Overall Perception of Management

Overall, the industry was satisfied with the handling of shellfish in South Carolina. They felt that most laws were appropriate and the department and the industry have learned how to work within them. Two industry members felt there were no real problems. Another member thought that the laws in South Carolina were as good as any in the country because anyone can enter the industry. Dissatisfaction was noted with the fact that the resource is being depleted every year and harvesters are unable to know from year to year what to expect of harvest levels.

Those interviewed felt that the resource has been healthy for the past two years. Some areas have oysters that are dying off for no known reason, but the clam harvest seems to be increasing in all areas. Many harvesters felt a decline in water quality and a loss of habitat due to development and wave action are some of the most important issues. Planting was stated as the most important aspect of management being ignored by the department, specifically planting on the State Shellfish Grounds. Those interviewed were also very concerned about the future of the industry. Two people stated that the younger generation is being discouraged from entering the industry. They also feel that overall, fewer people are in the industry because there are other jobs available that provide more income than the harvest can supply. They stated that the quality of the SSG harvest has been declining, which makes them question its sustainability if management of these areas is not changed.

Production and Condition of Resource

When asked how harvest production from the previous year compared to the past, there were varying responses. Five people felt the production had declined from the past, stating that oysters were dying off without ever working them, the quality was dropping, and there was low growth and size. Five people felt production levels and resource condition were constant. Two mentioned some natural cycles, but felt that overall the resource was staying the same. One person stated that production cannot increase until there are new areas to work. Seven people felt the resource was increasing. Five stated that during the past 2 years specifically, the oysters have been healthy. Two people noted the location specific aspect of the resource, which may explain why there were such varying responses to the question. Everyone who mentioned clams directly stated their production had increased recently, although they did not speculate as to why.

Respondents were then asked what they felt had the largest impact on harvest levels. Some gave more than one answer, but by far the most common response was harvester levels. Seven people felt that how the beds are harvested, where harvesters are allowed, and how many harvesters are working has the most impact on bed quality. Four people stated development has had a major negative impact, and three felt that pollution (whether from mosquito spray, motor oil, golf course runoff, or sewage) had the greatest effect. Three believed natural environmental conditions were most important, and four felt that boat traffic had the greatest impact on where oysters can grow and survive.

SCDHEC Management

Overall the industry is satisfied with SCDHEC management. Nine people were satisfied, four found management adequate and four were dissatisfied. Respondents felt that most laws were good and important to have, but a number of respondents would like to see the laws reviewed and have those that serve no direct public health purpose removed. A number of respondents also asked the laws to be clarified so they know why certain laws are in place. Most felt that shellfish sanitation was effective, and that the conservative nature of the laws is understandable and necessary since the entire state would be impacted in the event of a sickness. Those who were dissatisfied with SCDHEC management felt that laws were too particular and not related to real public health issues.

General statements on SCDHEC management varied greatly. Two respondents stated that they agreed with law enforcement officers in their handling of tickets, but they disagreed with decisions on which beds to close due to water quality issues. Three separate respondents wanted more emphasis put on testing and remediation so new beds could be opened as other beds were closed. Two people would like more meat testing than is presently done. Many respondents stated their dislike for having to follow regulations set by the Interstate Shellfish Sanitation Conference (ISSC) since South Carolina oysters are so different. Two respondents felt that imported Gulf oysters had higher fecal coliform levels than closed beds in South Carolina. Two people felt that 14 day automatic closure was too long and testing should be done faster. The largest complaint heard, was that paperwork was redundant and excessive. It was mentioned that a digital file would be very helpful, rather than filling out multiple forms with overlapping information. The HASSP plan was also discussed, and respondents felt that because of the ISSC regulations, officers had to be more concerned with whether the HASSP plan was in order than in whether the intent of the laws were being followed. The notification process for closing beds was questioned by a few people. Those that use the e-mail system or are called by staff did not feel the need to change the process, however two people felt a number to call and check on the status of beds would be helpful.

SCDNR Management

The industry is satisfied with SCDNR management, stating they were doing the best they could, with only one person stating they were dissatisfied with the department. The staff was credited with the positive outlook of industry on management. Jim Monck's dedication was mentioned by every person interviewed, and the need for more personnel was mentioned by five respondents. Pat Causby's depth of knowledge was also discussed by a respondent. Those people interviewed felt that cuts in SCDNR's budget are cutting into the effectiveness of the program. Respondents felt that there was consistent enforcement and that the point system works better than fines. Five people were not satisfied with law enforcement and would like to see more effort, specifically more time spent on the water. One respondent asked enforcement to explain why certain tickets are given out, which would help the industry understand why these laws are instated. If laws are changed, they would like to see simple and understandable reasons. Seven respondents stated the department works well with harvesters and is both reasonable and supportive. Respondents felt that the process of using hard card permits

to control harvest was working well. Those interviewed felt that SCDNR helps the commercial industry by supporting their interests and giving information when needed. One respondent felt that too much emphasis was put on recreational fishing, and the commercial industry should once again become the focus of the department.

Respondents felt that more planting was needed, both on state owned bottoms and on leased bottoms. Industry would also like to give input into planting location, because they have experience with what areas will grow best. They felt the department was underfunded, and that more people are needed for verifying Culture Permit (CP) plantings. Another area of discussion was the South Carolina shellfish market. A number of respondents mentioned the need to increase in-state production and decrease reliance on wild stock Gulf oysters. Those who have clam mariculture areas would also like to see clam harvest allowed in the summer so the market does not rely on out of state clams during that time of the year. Two respondents asked about SCDNR helping to market shellfish, as was done in the past. General suggestions for facilitating good management were: opening and closing beds on a longer schedule in addition to planting, encouraging more relay of oysters, breaking CP areas into smaller sections, and charging for state bottoms in CP areas where subtidal clam harvest exists.

Culture Permit Management

When asked specifically about Culture Permits (CPs), industry respondents felt that overall the program was handled well. They felt that the department worked with them to ensure they finished planting requirements and that each year there were good places to harvest. Those interviewed felt that the application process for CPs is fair, although three people stated there are few new areas opening up. One person felt that when new areas open up, they should be split into smaller CPs if possible so more people can obtain areas. Four people felt there needs to be more notification for new areas, including a public notice period. When asked whether fees and planting requirements were adequate, most respondents felt comfortable with present levels. Six people said the planting requirement could be increased and one said it should be decreased. One respondent felt that if the amount of cull in place harvesting was adequate, the planting levels would be appropriate, but since this is not the case the levels are too low. Five people said CP fees should be increased and four said the present level is appropriate. One respondent felt the subtidal usage on CPs needed to be reassessed because CP holders were not being charged for subtidal clam harvest.

Two people mentioned their frustration with CP areas being used as an asset and not worked, and another stated that large CPs need to be broken into smaller sections so all areas can be worked. It was pointed out that since CP holders can work SSGs, the CP areas are held in reserve. Respondents felt it was too easy to let some areas on the large CPs sit, rather than putting effort into working them to get a harvestable product. Two people suggested the department review how the CPs are being used and consider a usage requirement base on the acreage and productivity of the CP area. This they suggested could cause people to voluntarily turn portions of their CPs over to the department, which could be made into more SSGs or other CPs.

Mariculture Area Management

Overall, those members of the industry interviewed felt that the department was handling management of mariculture areas well. One respondent stated that while there may be some problems with mariculture itself, there were not problems with management of the mariculture industry. Two other people felt there needed to be changes in handling site loading and that environmental effects should be monitored. Those interviewed felt that requiring a yearly operations plan was a good idea, and that while there are potential conflicts, mariculture is the wave of the future and should be managed well. It was stated by a number of people that while it is difficult to begin mariculture production, SCDNR is helpful when someone starts and assists with obtaining necessary permits. The permit process was noted as having some difficulties. While one person felt the department should help with marketing, another did not feel the government should be promoting the industry and it should be left to harvesters to market. It was mentioned that the mariculture industry had hurt wild clam harvest to some extent since clams were available year round and wild clam summer harvest should be allowed since mariculture can sell clams outside of the normal shellfish season.

State Shellfish Ground Management

As opposed to the opinions regarding Culture Permits and mariculture areas, those interviewed are not satisfied with the management of State Shellfish Grounds (SSGs). They feel the beds are underfunded and overworked and SSGs need state funded replanting as is presently done for Public Shellfish Grounds (PSGs). They feel the double planting credit is good, but that requirements are not strenuous enough for SSGs to keep planting at necessary levels. Those interviewed stated the SSGs can be stripped within a couple of days to two weeks time, after which harvesters go through beds a second time and take oysters that should be left for restoration of beds. While they agree with the rotating of beds, they feel that rotation out of harvest should be longer to allow recovery, and in some cases the time allowed for harvest should be shorter to prevent overharvest. They are happy with the fact that there are SSGs available because this removed the monopoly on harvesting areas held previously by CP holders. A number of respondents stated they did not feel CP holders should be allowed to harvest on SSGs, and if their Culture Permit was maintained, they would not need to harvest on SSGs. One respondent felt there should be more of both SSGs and PSGs. It was suggested by two people to rotate SSGs and PSGs to allow the overharvested SSGs time to rest, and give the underharvested PSGs more work, since they felt that culling the PSGs would make them more productive.

Recreational Harvest Management

Most of those interviewed felt that recreational harvest was handled well, and that enough harvest areas exist. One respondent said he did not see many people harvesting from recreational areas, and another said that if anything the recreational only areas are underutilized. Three people stated that it would be good to have more, but because the existing beds are not planted frequently enough now, SCDNR should not add more areas that cannot be replanted. Three people interviewed felt there should be more recreational harvest areas, while four people felt there were enough, but there should be more areas accessible by foot. Three stated that there were enough areas because SSGs are always

open to recreational harvest regardless of whether they are closed to commercial harvest. One person felt there were too many recreational areas and that effort should be on SSGs that allowed commercial harvest rather than PSGs. One person thought there should not be designated recreational areas since recreational harvest is allowed everywhere, rather PSGs should be incorporated into SSGs. Many people felt there needs to be more publicizing of where recreational harvest is allowed. Five people stated they did not feel the public knew they could harvest on SSGs, and two felt they did not know they could not harvest on Culture Permit areas. They also felt there should be better access to maps, and information on harvest limits should be distributed more.

New Management Considerations

Industry members were asked whether they would support a number of new management considerations, the first of which was the use of shellfish sanctuaries to help resource recovery. Without exception industry members did not support this idea. Most pointed to their experience that cultivation is beneficial to growth and that many areas were underharvested or closed to pollution and served the purpose of a sanctuary. They also stated that having enough spat is not the problem in South Carolina; it is keeping beds healthy through maturity. Respondents also felt that unless there was more law enforcement, these areas would simply be harvested at night. Those that agreed with the idea of the sanctuary but not its usefulness in the state felt that having an area planted and kept out of harvest for one or two years would be useful, but to keep it from being harvested for longer than two years would not be good.

The second consideration was to increase fees for use by management. Ten respondents did not support this idea with five stating the fees were too high and five saying they were adequate, and six respondents supported increasing fees. Those that supported the increase of fees mentioned specifically the Culture Permit holders as being undercharged. They also stated they would only support using increased fees for maintenance of beds and a small amount for stock assessment. Two respondents stated that to increase the fees enough to make a difference, license prices would be prohibitive to the industry.

The third consideration was for independent harvesters who pick State Shellfish Grounds to be required to replant the SSGs used. Eleven respondents stated they would support a change in this policy and three did not support this idea. It was suggested that pickers could take shell back out if shell was supplied by DNR or could relay shellfish from restricted areas to approved areas. One respondent suggested harvesters could get shell from customers and deliver the shell to the department rather than planting themselves. Respondents also suggested having harvesters either plant or help with large scale planting prior to receiving the next year's license. One respondent felt this was more important than the license fee and would support a free SSG license if harvesters were required to plant. Two people suggested using a fee for replenishment rather than requiring the harvester to replant since the logistics of planting are difficult. In addition to the difficulty of replanting, a problem suggested by one respondent was that many people are working in another industry when the season ends. For this reason it was suggested that the importance of planting be conveyed to independent harvesters prior to changing the laws for independent harvester requirements.

The next two considerations were grouped together as harvest limitations. The majority did not support limits; however more respondents supported a harvest limit rather than a limit on the number of harvesters. Four supported and five did not support a harvest limit, while two supported and three did not support a harvester limit. One person suggested a bushel limit rather than a size limit, and two suggested a boat limit instead. Those that supported the harvest limit suggested that there would be more quality picking if there were a limit in place. It was pointed out that with the shortage of enforcement officers to verify or enforce the limit, it would only instigate people to clean out a bed faster to get their limits before others. Problems raised when considering a harvester limit include legal issues of equality, the lack of enforcement, and the possibility that some harvesters will get a sticker and not harvest while others are not allowed to harvest.

The last suggested consideration was allowing alternative planting on SSGs. Nine people supported this while only one did not. The person that did not support alternative planting did not feel that anything except shell should be used since it builds substrate best. Those who supported the option felt that since it is so difficult to get shell, this would be a better option than doing nothing at all. They suggested having more relay and moving of shell and they pointed out that some methods will work better than others in different locations. One respondent stated that SCDNR should have the flexibility to allow alternative planting even if it is not done often.

The respondents were then asked any other suggestions they had for improving the quality of SSGs. A number of responses were given:

- Five people suggested increasing the number of SSGs. Two people suggested doing this by taking dormant acreage on CPs. Two people suggested increasing acreage by putting PSGs into rotation with SSGs, which would get more use out of the PSG areas and allow SSG areas to rest in years they functioned as a PSG. This would also introduce recreational harvesters to more areas since it was believed that many do not know they can use SSGs. Rolling or partial closures were also suggested since many areas are cleared out in a very short time period. It was suggested that the department close beds based on periodic assessments rather than set dates.
- Two people suggested requiring cull in place. It was stated that clusters should be separated into groups of no more than three or four. One person also suggested making a size limit based on the largest oyster in a cluster.
- Two people suggested having a production requirement on CPs. It was believed that this would decrease the effort on SSGs from CP holders. The requirement would be based on the possible productivity of the acreage, not just acreage amount. It was also suggested by one respondent to not allow CP holders to use SSGs, or require an extra payment for use of the state bottoms in addition to their CP acreage.
- A number of respondents felt SCDNR should begin planting SSGs in addition to PSGs. Most respondents felt the state should fund this planting, but it was also suggested that this could be done by making a bushel charge dedicated to replanting. One person also felt that the

amount of relay and relocation of live oysters should be increased and could be done on SSGs.

- Changing recreational limits from two bushels of oysters to one bushel of oysters. A respondent suggested that this would reduce the pressure from recreational harvest and still allow enough oysters for personal use. Another respondent felt there should be no commercial harvest on SSGs and that only CPs should be used for commercial harvest.

Replanting

The last question concerned selection of areas for replanting. Many of those interviewed did not replant with shell and instead used mainly alternative methods. Those methods mentioned as good were bamboo stakes, wire (two responses), cemented stakes (three responses), washed shell for clams, fossilized limestone, and relay of oysters (three responses). The process of raking as a substitute for replanting was questioned by two respondents who felt that raking shell from one portion of the bed to another simply broke up clusters rather than putting out new material. Many stated that while spreading shell was the best, alternative methods did work. The preferred method varied depending on location. One respondent felt that alternative methods work best on soft bottoms because shell would sink into the mud. Another stated that wire is best to start a bed area, but bamboo is best when increasing the amount of oysters on a riverbank with some established beds. If shell were available some respondents would use it for replanting rather than other methods. While another felt that one dollar per bushel would be reasonable and local shell would be preferred to out of state shell, one respondent stated that the cost of moving shell is more important than the actual cost of shell. The respondents felt the best areas for replanting were in low traffic areas where there are a few oysters growing on a bank, thereby showing the possibility for bed development. It was suggested that the department should cultivate existing beds rather than trying to make new ones, and that the industry should be contacted for ideas of where to plant. It was also suggested that the department use statistics to determine which beds are used the most and replant those areas since growth in those areas is steady.

Additional Discussion

Additional discussion with industry members ranged over a number of topics. There was some mention of departmental changes they would like to see. Many people interviewed mentioned the need for DHEC-OCRM to limit dock permits, specifically floating docks near oyster beds. They would like the DHEC marina closure methods to be more fully explained because they feel unsure that water flow is being considered. They also believe that the fecal coliform process is outdated and pressure should be applied to the FDA to change. There was also discussion about possible initiatives they feel would be positive for the industry. Three people stated their needs to be a steam plant to provide jobs and supply more shell for replanting. The industry also stated that having more beds is not the solution. They would like to see more proper cultivation of the present beds to provide more quality oysters for sale. A number of people interviewed stated the need for better marketing South Carolina product. They felt that local shellfish should be marketed in South Carolina outside of the coastal region. One person also mentioned the fact that single oysters are in much greater demand

commercially and should be cultivated. Finally, a number of people interviewed mentioned the defunct state shellfish association. They felt that this should be brought back to give the shellfish industry a central voice.

Questions used to guide industry interview discussions

1) In general, how satisfied or dissatisfied are you with the oyster industry at this time?

2) How do your harvest production and oyster condition for this year compare to the past? Over the past 10 years do you think the quality of the oyster resource has improved, remained the same, or declined? What do you believe to be the reason? What do you feel is the biggest concern to harvest levels?

3) In general, how satisfied or dissatisfied are you with SCDHEC management? Do you feel DHEC shellfish control is effective? Is the shellfish bed closure notification process adequate? Would a phone number with information be more useful?

4) In general, how satisfied or dissatisfied are you with SCDNR management? What do you believe to be the primary responsibilities of SCDNR? Are you satisfied or dissatisfied with DNR's performance in meeting these? Why? Do you think SCDNR should direct more, the same, or less effort into administration or enforcement of regulations? In what areas do you believe the department needs improvement? In what areas do you believe the department is doing well? Do you believe applicants for shellfish culture and mariculture permits are treated fairly by DNR, particularly when there is competition for certain areas?

5) What is your opinion regarding the management of culture permits? Do you agree with the requirements placed on culture permit holders? Are the hard card permits and decals effective in controlling harvest?

6) What is your opinion regarding the management of mariculture areas? Should DNR direct more, the same, or less effort into promoting mariculture?

7) What is your opinion regarding the management of SSGs? PSGs?

8) How would you rate DNR in their management of the recreational fishery? Should there be more recreational harvest areas, or do you feel the number at present is adequate?

9) Do you believe restoration areas/shellfish sanctuaries would benefit the resource? If so where and how large?

10) Would you support or oppose:

A) an increase in current license fees in order to cover costs of management and replanting on state grounds?

B) a requirement of independent commercial harvesters to replant the specific public beds they use?

C) a harvest limit placed on commercial harvest from state shellfish grounds?
D) a limit on the number of harvesters allowed on any given SSG?
E) allowing alternative methods of planting to be done on SSGs in addition to the limited planting by culture permit holders?

11) Do you have other suggestions for controlling heavy harvesting on SSGs?

12) What do you consider the most important factor when replanting a certain area? What do you feel is the most efficient process; laying shell, relaying seed, or another alternative method? Should culture permit holders be required to plant a certain percentage of their quota with shell cultch? If shell cultch was available, would you be willing to purchase shell to plant? How much per bushel?