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VIRGINIA MARINE RESOURCE REPORT 94-6

VIMS/W&M BLUE CRAB FISHERY STATEMENT

Romuald N. Lipcius and Jacques van Montfrans

17 October 1994

I. Status of the Blue Crab Stock in Chesapeake Bay

Various indices based on VIMS long-term data sets indicate a significant decrease in Catch Per Unit Effort (CPUE) for the fishable segment of the stock, as well as for juvenile blue crabs. The blue crab population in Chesapeake Bay appears to have been and continues to be in a low phase of population abundance (Fig. 1). The decline in CPUE is also reflected in dredge fishery landings (Figs. 2 & 3), and in comparable measures of adult female abundance from the VIMS/W&M Trawl Survey (Figs. 1 & 3). Concurrently, as monitored by VMRC, fishing effort has increased substantially in the blue crab fisheries. Finally, our most recent indices for juveniles and the fishable stock indicate that the blue crab population is likely to remain in a low phase over the next 6-12 months (Figs. 4 & 5). These collective patterns are symptomatic of a fishery in the process of being overharvested. Prudent management practice argues strongly for controls on fishing effort to prevent a major decline in the fishery, or worse yet, a collapse if environmental conditions coincidentally deteriorate (See Appendix).

II. Components of the Fishery Requiring Regulation

The most serious concern is the protection of the spawning stock, given the demonstrated relationship between spawning stock and recruitment of the blue crab in Chesapeake Bay. This relationship dictates that the number of crabs recruiting to Chesapeake Bay in any given year relies, in part, on the size of the spawning stock from which the recruits originated. The potential spawning stock includes all females, and is not merely limited to those crabs possessing a sponge (egg mass), nor to those mated adult females about to produce an egg mass. Of particular importance are those juvenile and prepubertal females larger than 80-100 mm in carapace width (approximately 3.2-3.9 inches), since those females suffer relatively low natural mortality (except during molting), and therefore, would reproduce were they not fished.

Those females composing the potential spawning stock are susceptible to various fisheries in Chesapeake Bay, including the hard crab pot fishery, dredge fishery, and soft crab fishery. Hence, all fisheries require equitable and effective regulation, without undue restriction of any single fishery. Inappropriate emphasis on one fishery of the stock, irrespective of the stage of maturity of the crabs caught in that fishery, might hinder effective regulation of other fisheries having a greater impact on the spawning stock. Furthermore, due consideration should be given to the fisheries depending on

their proportional harvest of those females comprising the potential spawning stock. Our preliminary calculations based on VMRC landings data suggest that the hard crab pot fishery capture well over half of the potential spawning stock; that the dredge fishery accounts for approximately 15 % of the spawning stock; and, that the soft crab fishery likely harvest less than 10 % of the potential spawning stock, though various sources of error could alter these estimates considerably. Of these estimates, the contribution of the soft crab harvest is least well known. Overall estimates await further refinement based on data derived from VMRC's mandatory reporting system. Regardless, initial attempts at management should be allocated proportional to these estimates of spawning stock harvest.

III. Statements on Proposed Fishery Regulations

ISSUE: *Establish the number and size of crab dredge gear to be used during the 1994/95 season.*

STATEMENT: Although the proposed dredge size limitations could place an undue burden on watermen for the upcoming winter (1994/95), gear limitations would reduce the impact of the dredge fishery on the spawning stock. Consideration should be given to such a regulation relative to those already in place for the dredge fishery (i.e., Would this be an example of inequitable regulation?), and if approved it should be implemented well in advance of the winter dredge season to minimize the economic hardship on watermen.

ISSUE: *Establish open and closed seasons and corresponding time periods for the taking of hard crabs.*

STATEMENT: Although the proposed open season (i.e., April 1 - November 30) is unlikely to reduce effort substantially in the hard crab pot fishery, it does set a precedent for a necessary limitation of effort in that fishery, and therefore is recommended. Additional limitation of the open season would constitute a more effective conservation measure.

ISSUE: *Require cull rings in hard crab pots and determine the size of the cull rings.*

ISSUE: *Establish time periods and areas for cull rings to remain open.*

STATEMENT: Both of these proposed regulations are expected to increase the survival of smaller crabs so that they may either reproduce or be harvested at a larger size by other fisheries. Hence, they are viewed as beneficial, particularly in enhancing the total yield of the blue crab fisheries. The opening and closing of cull rings at certain times and within particular areas has no conservation value. We consider mandatory inclusion of cull rings without exemptions for seasonal and area closure to be most beneficial to the fishery and spawning stock.

ISSUE: *Require a five (5) inch minimum size limit for all hard crabs, male, female and immature female, in combination with the requirement for each hard crab pot to contain two 2 3/16-inch cull rings.*

STATEMENT: This issue has two parts. The second part, dealing with an additional cull ring, is recommended if studies show that the additional cull ring significantly increases the survival of crabs over that resulting from a single cull ring. The first part, dealing with a minimum size of 5 inches for crabs, would change current regulations only for adult females since the 5-inch size limit is in place for other hard crabs. We do not recommend this regulation for two reasons. First, there is a positive relationship between female crab size and fecundity (Fig. 6). That is, larger adult females produce significantly more eggs than smaller females. Second, there is likely to be at least a partial genetic basis for size at maturity in the blue crab, with the consequence that a minimum size might be selecting for smaller female size at maturity, and the resultant lower fecundity. In both cases, the reproductive output would probably be reduced markedly if a minimum size for adult females is enacted. On the contrary, we recommend consideration of a maximum size limit to protect those females which produce the most eggs in the population, similarly to the regulations governing some finfish fisheries. Lastly, as a related conservation measure, we recommend the consideration of biodegradable panels to allow the escape of crabs from ghost pots. These pots would otherwise remain in the environment and continue self-baiting and fishing for as long as the wire mesh remains intact.

ISSUE: *Adjust the current time-of-day limitations on crabbing.*

STATEMENT: This regulation is likely to reduce effort in the hard crab pot fishery and therefore should be enacted although its impact will be primarily upon those watermen with a large numbers of pots. We urge consideration of both a starting and ending time limitation to prevent simply displacing fishing effort to later in the day.

ISSUE: *Establish open and closed seasons and corresponding time periods for the peeler pot fishery.*

STATEMENT: A closed season beyond that imposed by nature will have a positive effect on the spawning stock provided gear restrictions are effective. However, given the current estimates that the soft crab fishery harvests a relatively small proportion of the spawning stock, the proposed regulation is likely to have a proportionally small effect on spawning stock conservation.

ISSUE: *Establish a minimum size limit for peeler or soft crabs.*

STATEMENT: Peeler crabs develop a size refuge (i.e., as a crab grows to some large size, it is unlikely to be eaten by predators) as they approach 80 - 100 mm (3.2 - 3.9 inches) in carapace width.

Above these sizes they experience mortality primarily in the soft-shell phase while shedding. Below these sizes, crabs are highly susceptible to natural mortality through predation, even in the hard-shelled condition. Thus, a lower limit of three inches on the harvest of crabs less than 80 - 100 mm will simply allow some of those individuals to experience natural rather than fishing mortality. An additional consideration is the potential mortality induced by increased handling of peeler crabs during inspections by law enforcement officers.

ISSUE: *Require cull rings in peeler pots, peeler traps or pounds and determine the number, size and location of the cull rings.*

STATEMENT: This issue encompasses two primary types of soft crab fishing gear, peeler pots and peeler pounds, which operate in fundamentally different ways. We understand the general consensus of watermen to be that unbaited peeler pots operate by providing a refuge for crabs about to molt. Thus, the likelihood of a crab attempting to escape (and of a non-shedding crab to enter) a peeler pot is highly unlikely. We recommend studies to address this issue before approving regulations for which there might otherwise be no justified reason. We also recommend that regulations be passed (if not already in place) that restrict the baiting of peeler pots with anything other than male (Jimmy) crabs. Peeler pounds operate by non-selectively harvesting hard and peeler crabs as well as various fish which are directed into the heart of the trap by the lead. Thus, the catch could potentially consist of small hard crabs which would attempt to escape from the trap. Under these circumstances, cull rings would enhance the escapement of sub-legal crabs and potential fish predators, thereby enhancing the survival of target peeler crabs inside the pounds. We therefore recommend the inclusion of cull rings in peeler pounds with the understanding that this regulation might have a limited positive impact on the spawning stock.

ISSUE: *Establish limits on the number of peeler pots that may be set at certain times of the year and on the number of licensed peeler pot fishermen per boat.*

STATEMENT: These restrictions would likely have a positive influence on the spawning stock if gear limitations realistically reduce the fishing pressure on the resource. Again, however, since the peeler fishery may harvest only a small proportion of the total spawning stock, this regulation would likely have a proportionally small effect on the stock.

ISSUE: *Limit or restrict the taking of sponge crabs.*

STATEMENT: Restricting the taking of sponge crabs targets that fishery which almost exclusively harvests hard, egg-bearing females that migrate to high-salinity water to release larvae between the months of May to September. This regulation would undoubtedly have a positive impact on the spawning stock, though the exact effect on the spawning stock relative to regulations on other fisheries remains undefined until accurate landings data are available.

ISSUE: *Establish additional sanctuaries or expand the current sanctuary. This management option could be used in combination with or in place of the above regulatory proposals to achieve conservation.*

STATEMENT: The sanctuary concept is often a productive and manageable way to protect and conserve an exploited resource. For the blue crab population, this issue comprises two important approaches to resource conservation. First is the concept of expanding the current breeding sanctuary. Second is the concept of a nursery sanctuary where postlarval blue crabs settle and grow during their early juvenile instar phases. Both can have beneficial effects on conserving the blue crab resource. Expansion of the existing sanctuary should include restrictions to all forms of fishing and will allow more egg-bearing females to gain refuge from fishing pressure. A new concept not yet considered in Virginia is the establishment of nursery sanctuaries of sufficient size to protect settling and growing juvenile crabs. Data collected over numerous years indicates that seagrass beds are of vital importance as settlement and nursery habitat during early growth stages for blue crabs in Chesapeake Bay. We estimate that over half of the blue crab population finds nursery habitat in submersed grassbeds despite their limited distribution throughout the bay (Fig. 7). Thus, protection of these habitats in concert with expanding the existing sanctuary will enhance overall conservation and we strongly support both of these approaches.

ISSUE: *Amend Regulation 450-01-0093 to delete Section 3.C. which authorizes the Commissioner to allow crab pot cull ring closures for specific times and in specific areas.*

STATEMENT: As noted in earlier statements, closure of cull rings is contrary to increased yield and conservation of the blue crab stock.

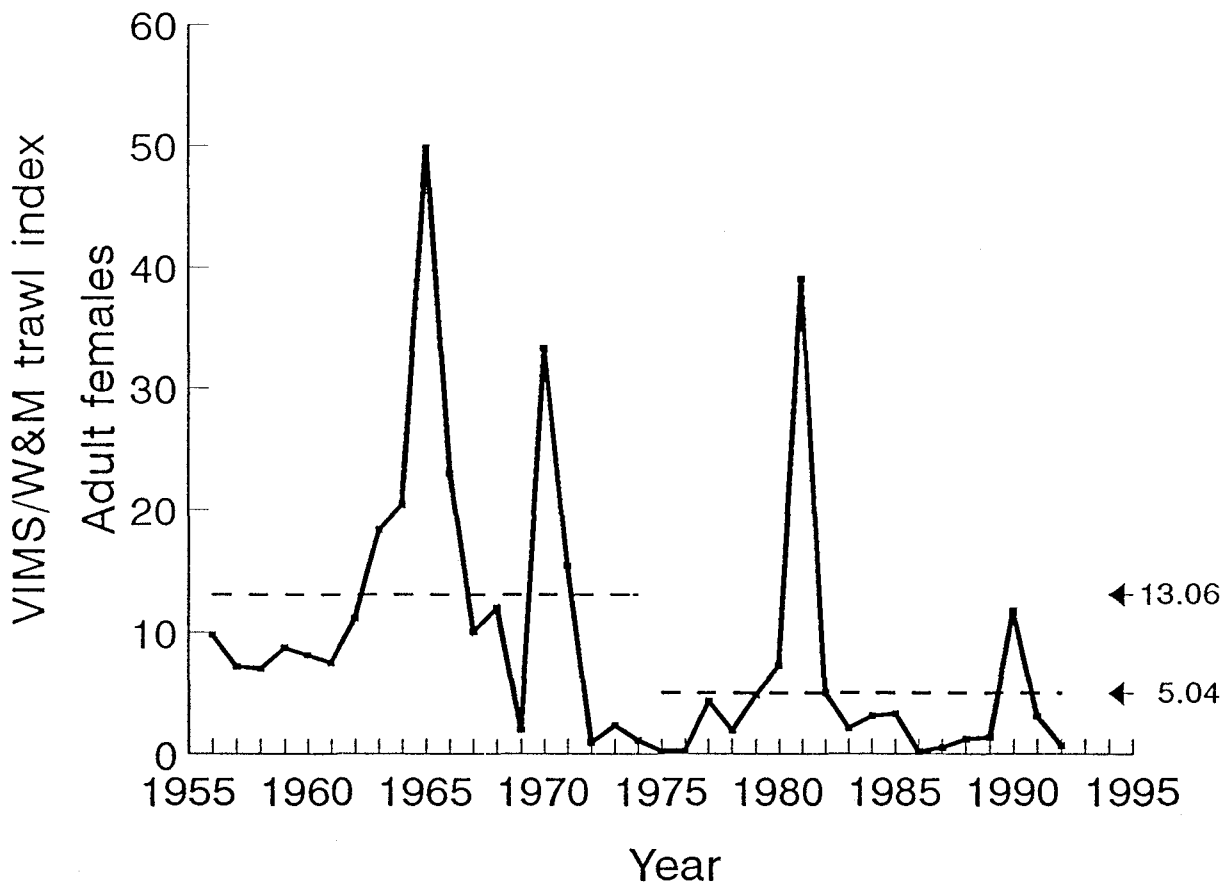


Figure 1. Adult female crab abundance (catch per unit effort) from VIMS/W&M Trawl Survey by year for 1956-1992. Note the relatively low level of abundance during the past two decades. Dashed lines indicate means for each period shown.

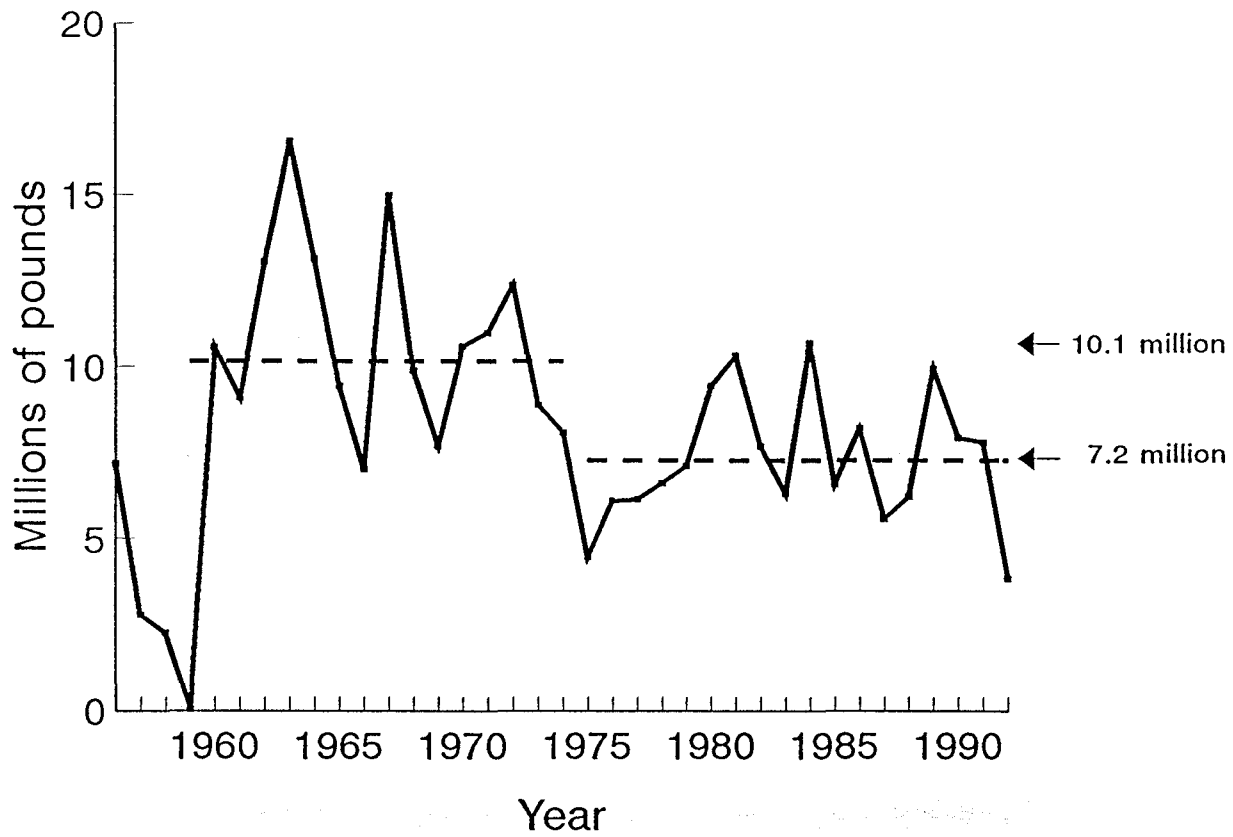


Figure 2. Landings from Virginia commercial dredge fishery 1956-1992 (VMRC data). Dashed lines represent means for the periods indicated.

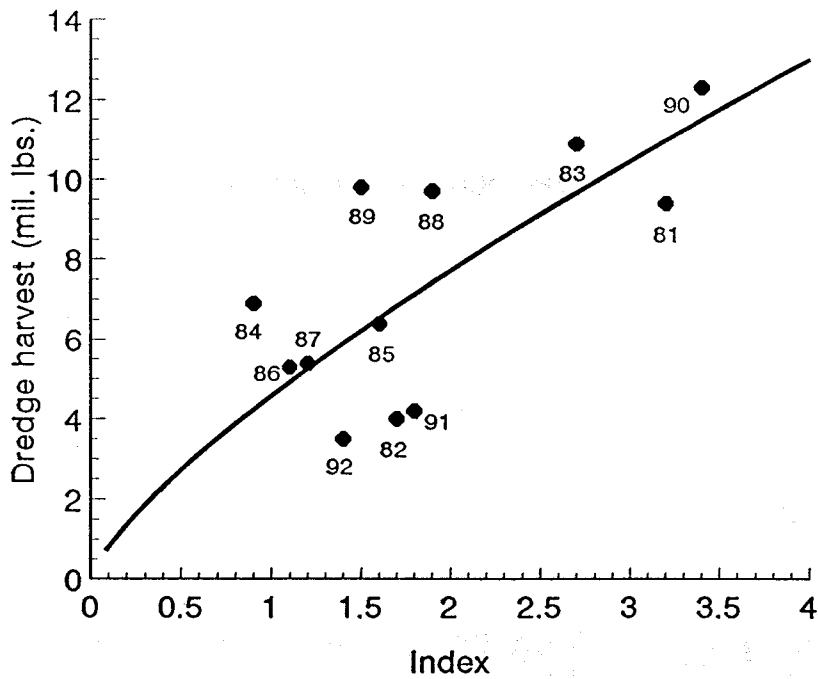
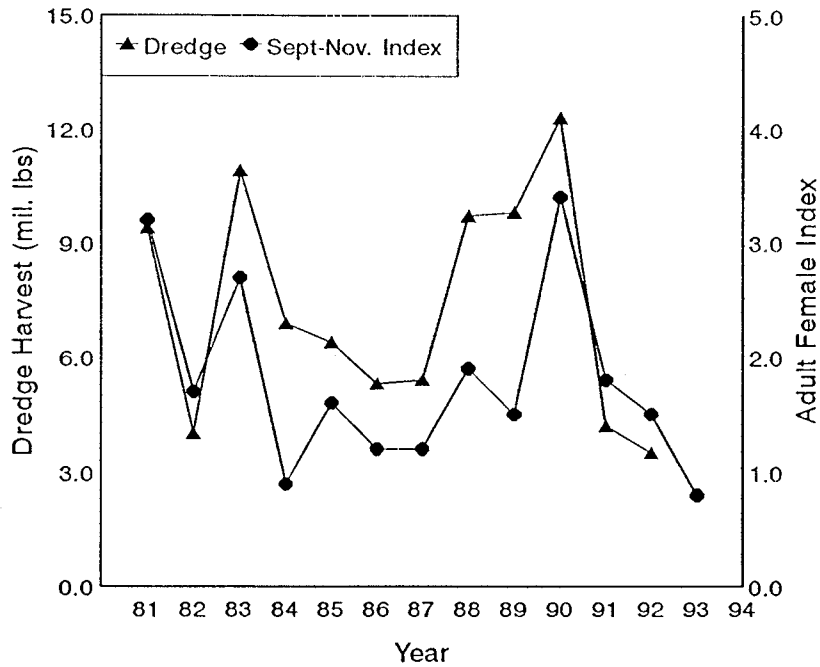


Figure 3. Indices of stock abundance (catch per unit effort) for 1981-1993. Shown are the commercial dredge harvest and the adult female index from the VIMS/W&M Trawl Survey. The lower plot is the resulting regression of dredge harvest on adult female index, with years indicated.

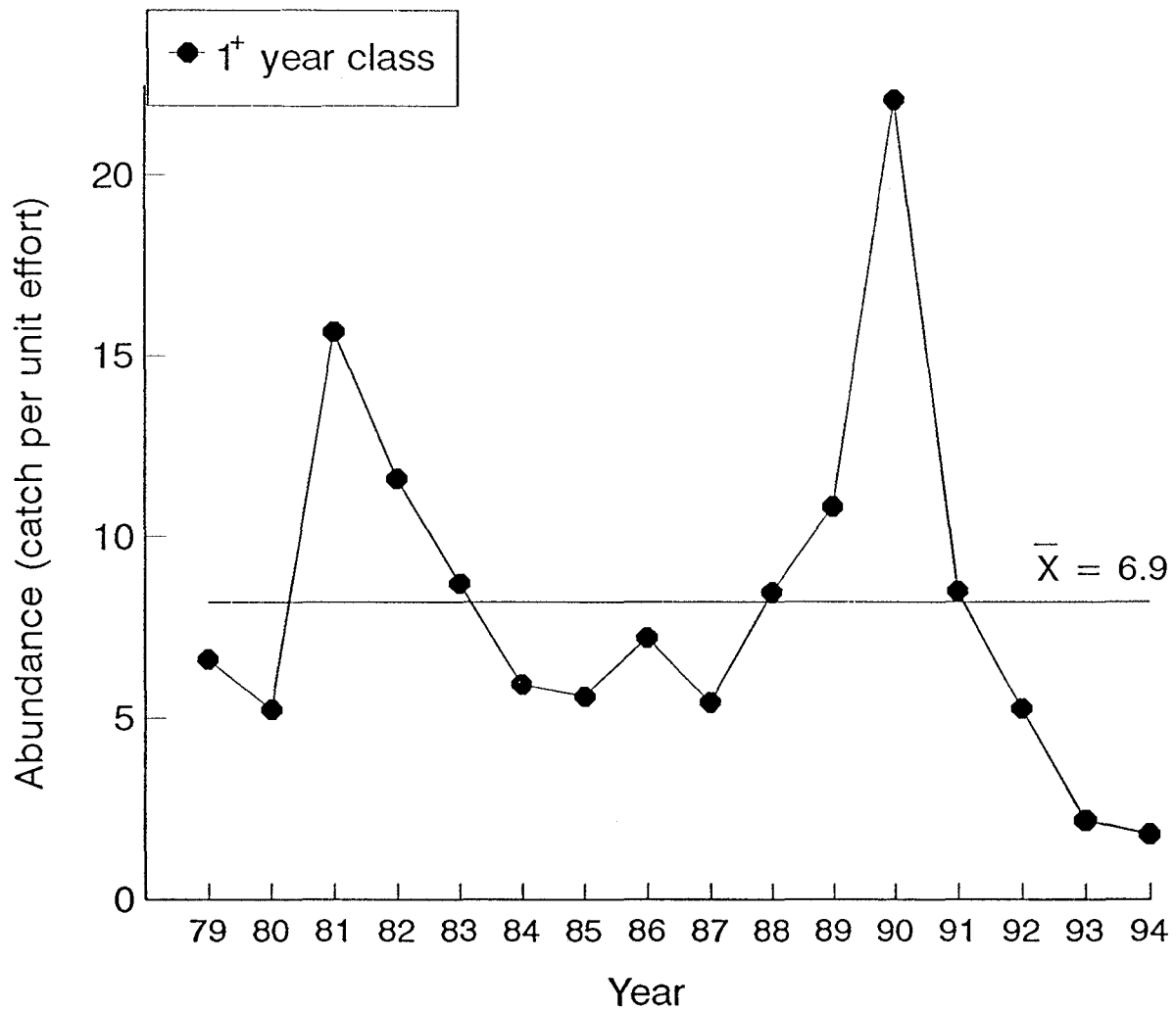


Figure 4. Variation in abundance (catch per unit effort) for 1979-1994 based on the 1⁺ year class of larger juvenile and adult crabs captured during June-August in the VIMS/W&M Trawl Survey. Note the low index value for 1994 relative to all previous years (the mean for the period is indicated).

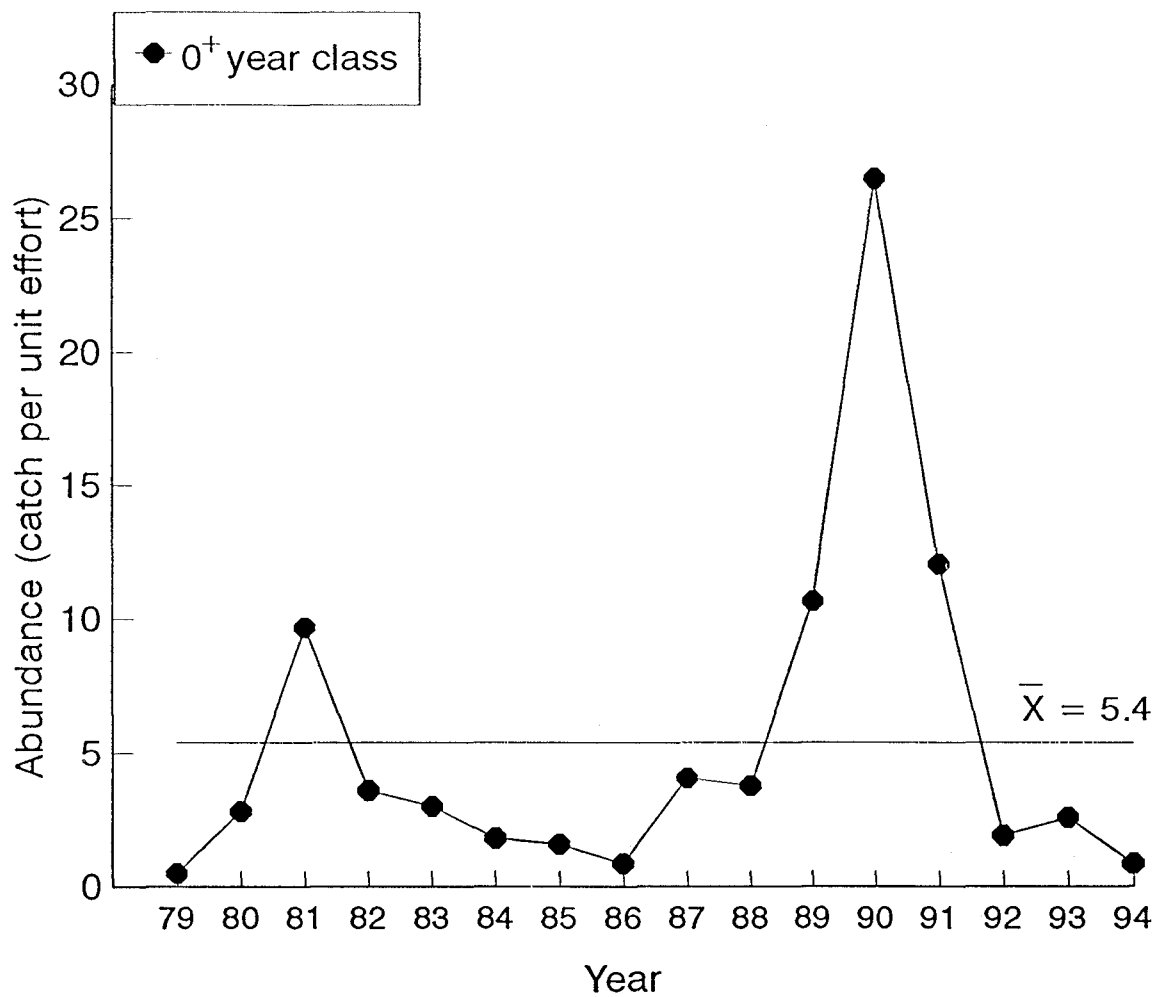


Figure 5. Variation in abundance (catch per unit effort) for 1979-1994 for the 0+ year class of juvenile crabs captured during September in the VIMS\W&M Trawl Survey. Note the low index for 1994 (the mean for the period is indicated).

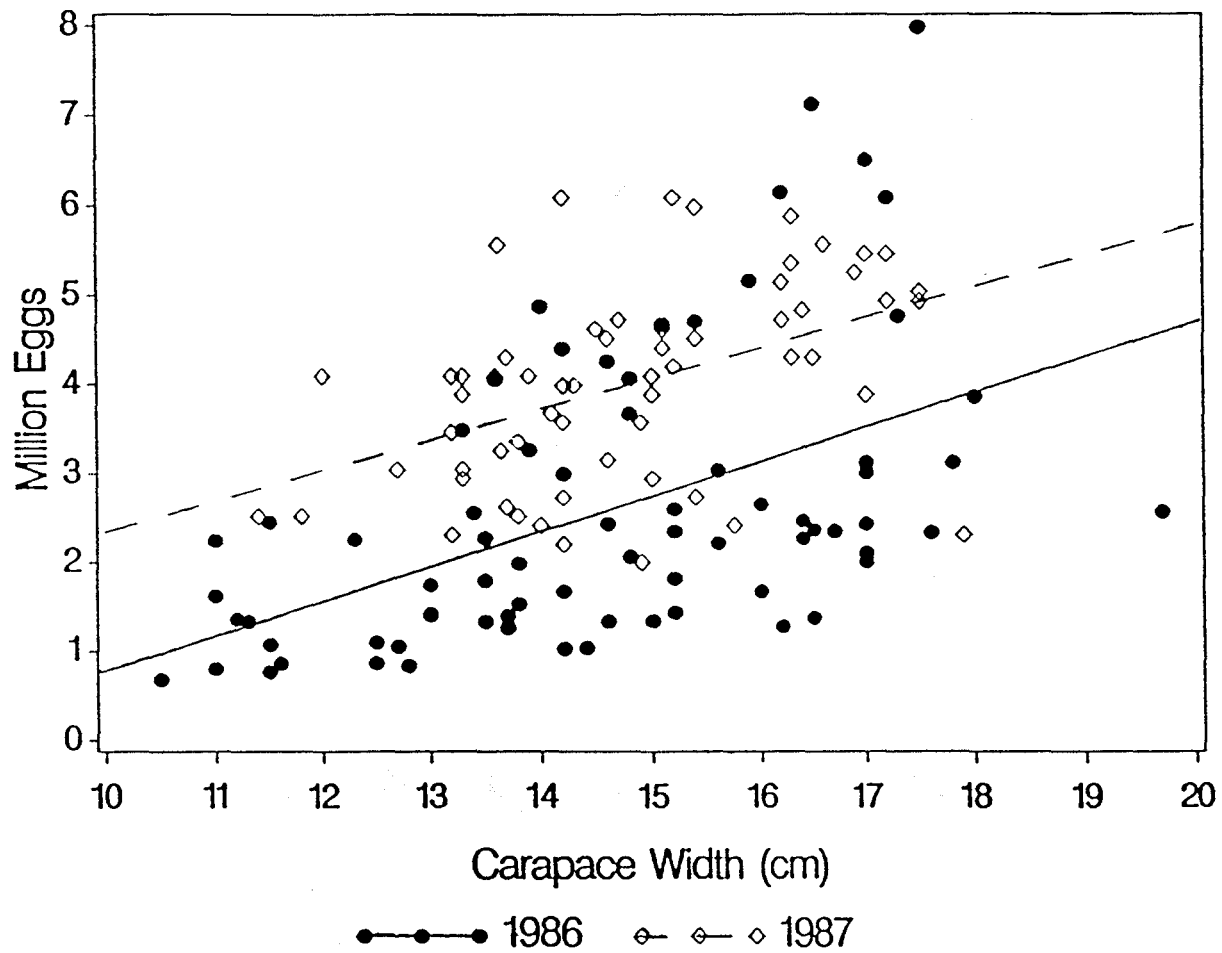


Figure 6. Relationship of carapace width to fecundity in 135 ovigerous blue crabs from Chesapeake Bay. The regression lines reflect patterns for each year (from Prager et al., 1990).

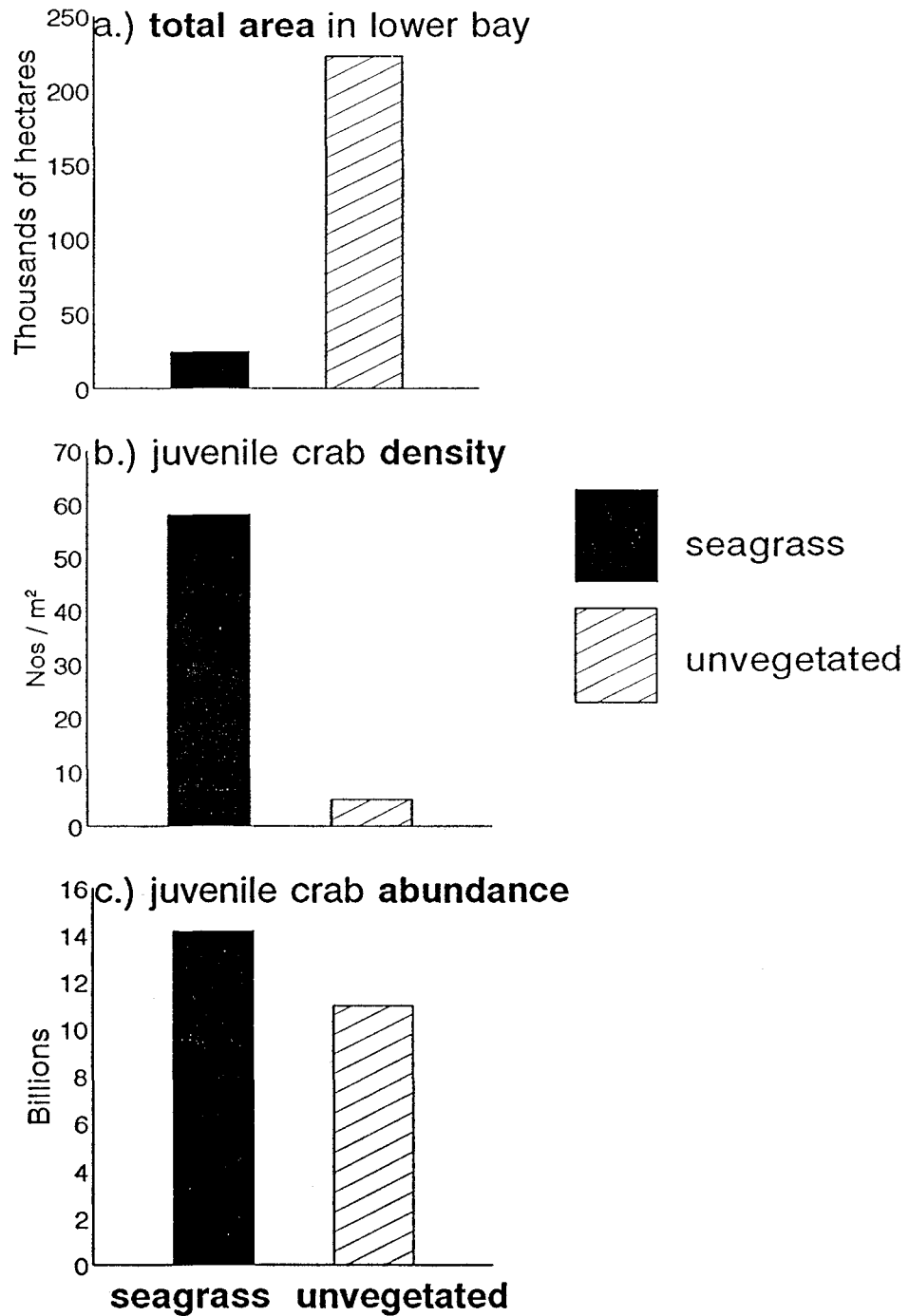


Figure 7. Estimates of the total number of blue crabs in the Lower Chesapeake Bay. Figure a denotes the total area of submersed bottom in the lower bay which is less than 2 m in depth. Figure b represents the mean density of juvenile crabs in vegetated and unvegetated areas of the lower bay. Figure c shows the resulting estimate of juvenile crab abundance in vegetated and unvegetated lower bay habitats occurring in less than 2 m water depth.

MARINE BIOLOGY

Biologists Sort the Lessons of Fisheries Collapse

The recent drumbeat of news reports about the collapse of many North American fisheries came as no surprise to fisheries biologist Vaughn Anthony. Anthony, who is the chief scientific advisor for the New England region of the National Marine Fisheries Service (NMFS), has been tracking declining fish stocks off the southern New England coast for years. Now, he says, "any dumb fool knows there's no fish around." Bottom-dwelling fish such as cod, haddock, and flounder are at or near all-time lows, and the venerable fishing industry there is collapsing. And New England is not alone: NMFS estimates that fully 45% of the fish stocks whose status is known are now overfished, and populations of some species have plummeted to less than 10% of the optimum level—the level that yields the largest sustainable catch. Says Anthony, "The status of the stock is so bad now that [nobody argues] about it."

But there's plenty of argument about how this crisis developed. Fishers blame a regulatory bureaucracy that was slow to act, while regulators say they were looking out for the industry's economic interests or that they were blindsided by unpredictable population swings and efficient new fishing technologies. Regulators also complain that biologists' uncertain estimates of fish populations and acceptable fishing levels failed to offer a solid case for tight fishing restrictions.

All of these claims carry varying degrees of truth, depending on the fishery. Still, most observers say that scientists have been giving clear warnings of the decline for years. Says Carl Safina, marine conservation director of



In the doldrums. Cape Cod fishing boats and a species that has been a mainstay of the New England fleet, the winter flounder.

the National Audubon Society, "The bottom line is that in fisheries where people have paid attention to the scientific recommendations, there are still fish around. In fisheries where the scientists have routinely been ignored or the most optimistic gloss has been put on the data, we have declines."

That bottom line may now be heeded. One result of the current crisis may be to build support for more cautious catch limits based on population data, even if the data are limited. The National Research Council, in a report issued this month, is calling on Congress to revise the current law governing fisheries management, the Magnuson Act, to build more biology into the regulatory process (see box). And at the same time, scientists are trying to play a savvy political game by stressing the long-term economic benefits of cautious fisheries management. If these efforts succeed in limiting the fishing pressure,

biologists say, even New England's sadly depleted fish populations stand a good chance of recovery—given enough time.

If so, it will be a homegrown solution to what is largely a homegrown problem. The Magnuson Act, passed in 1976, claimed for the United States the exclusive right to manage fisheries within 200 miles of its coastline, where the vast majority of commercial fishing takes place. The act excluded most of the foreign fishing vessels that were fishing these waters intensively, but the ensuing windfall of fish led

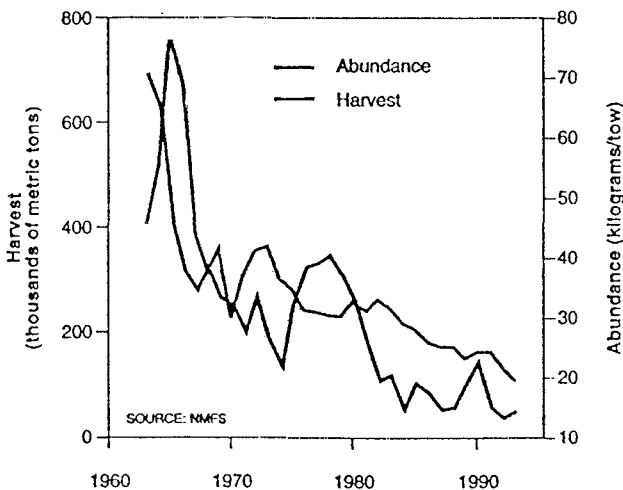
to a massive buildup of the U.S. fishing fleet.

Overfishing was supposed to be checked by eight regional fishery management councils, with the help of scientific advisers on the council staffs and at NMFS offices. These advisers monitor fish abundance based on the commercial fish harvest itself and on data from research vessels that fish at random. Since most fish are highly mobile and patchily distributed, however, fisheries biologists admit they're often lucky if their population estimates for any given year are within 30% of reality. Nor can scientists always tell whether fishing rather than natural factors

such as shortage of prey or climate change is the key factor in a population decline, says marine scientist Brian Rothschild of the University of Maryland at Solomons. Human activities other than fishing can also affect abundances. Most notoriously, salmon populations off California, Oregon, and Washington almost certainly owe much of their steep decline not to fishing but to destruction of their spawning streams by dams and logging.

Signs of trouble. Despite these gaps in their understanding of fish population biology, most fisheries scientists—and many in the fishing industry as well—agree that only rarely do they simply blow the call on how much fishing a population can stand. Scientists can tell that a population is in trouble when its mortality rate, calculated from the age distribution of the fish in the commercial harvest, shows a steady rise, says Andrew Rosenberg, an NMFS scientist. Other factors besides fishing may be contributing, but a cutback in fishing is the only remedy available in most cases. For now, the sorry state of many fish populations often makes the scientists' call an easy one. "No matter how badly you estimate [reproduction] or natural mortality, you still will come to the conclusion that you should reduce the fishing mortality rate," says Rosenberg.

But where the shortcomings in the science do make a difference is in the researchers' ability to influence policy. Many fisheries scientists have seen the current crisis coming for as much as a decade, say Rosenberg and his colleagues, but when they presented their data to the management councils, their penchant for speaking in terms of probabilities and confidence intervals often served them—and the fish—poorly. Joseph Brancalone, a former fisherman who chairs the New England Fishery Management Council, for example,



Decline and fall of the New England fishery. The total harvest of groundfish (cod, haddock, flounder, and others) and their abundance, as measured by random trawls.

argues that uncertainties in the population estimates weakened the case for severe restrictions. Carl Paulsen, program director of the National Coalition for Marine Conservation, an environmental group, agrees that the uncertainty leaves plenty of room for policy disputes. "We've argued that if there's uncertainty, you should err on the side of the resource," says Paulsen. "Industry has argued that you should err on the side of economics and the fishing industry."

And industry's voice tended to carry weight with the councils, say Paulsen and others, in part because of a decision made by Congress when it established the councils in 1976. Because it intended them to draw heavily on the expertise of the fishing industry, Congress went so far as to exempt council members—most of whom are federal appointees—from federal conflict-of-interest rules. As a result, members often hold direct interests in the fisheries they regulate. Such conflicts don't always lead to overfishing, but some councils have consistently overridden scientists' recommendations, many scientists and conservationists charge. "You have people in the industry, with livelihoods at stake, being unable to take the hits necessary to rebuild the stocks," says Paulsen.

Among the worst offenders has been the New England council, says Safina, who calls it "incredibly irresponsible and stupid" for allowing persistent overfishing of cod and flounder stocks. Despite a decade of warnings from fisheries biologists, the council has stubbornly resisted setting direct limits on fish harvests. Only recently did the council agree to restrict harvests by gradually limiting the number of days each boat can fish. And that plan is still not fully implemented. For now, says NMFS's Vaughn Anthony, fishers still catch around 60% of the entire fish population each year—more than twice the sustainable level. "There's no room for rebuilding here," says Anthony.

Brancaleone, the chairman of the New England council, notes that it did respond to scientists' concerns by trying to reduce harvests through other, indirect, means: imposing minimum net-mesh sizes (which let more young fish escape) and staking out no-fishing zones. He defends the council's slow phase-in of more stringent controls as necessary to protect fishers from the economic pain of overregulation. Besides, he says, the science doesn't show a clear need to move any faster. "The data that we have are so slim that we can't put a number on [the effect of the controls]. By the third or fourth year, we'll have the data that will tell us [whether further restrictions are needed]," he says.

But more aggressive management has paid off in other fisheries, say researchers. Even the most outspoken critics of fishery management, such as Safina, agree that the North Pacific management council has done a good

A Call for Better Science

For scientists whose warnings failed to check the depletion of some of the United States' richest fisheries over the past 15 years (see main story), a panel convened by the National Research Council (NRC) has some advice: Take a broader scientific approach and reduce the uncertainty in your forecasts. More confident forecasts are needed to catch the attention of regulators, the panel says in a new report.*

The report comes as Congress gets ready to re-authorize the Magnuson Fishery Conservation and Management Act, a 1976 law that extended the bounds of U.S. fisheries and created regulatory bodies to conserve fish stocks. The failure of those mechanisms has made it clear that the Act needs reform, and federal scientists turned to the NRC for advice about how to do so.

The report takes fisheries managers to task for failing to uphold a key principle of the Act—that "conservation and management measures shall be based on the best scientific information available." But it also says that available scientific information is often weak, noting in particular that fisheries scientists "have given virtually no consideration" to how fishing a single species can alter the rest of an ecosystem, making yields unsustainable. As a result, says NRC panel chair John Magnuson, a limnologist at the University of Wisconsin at Madison (no relation to the Act's eponym), "you can end up with situations in which one fishery is directed at a predator and another at its prey, yet the two fisheries are managed as though they are independent."

For this reason, the NRC report calls for an "ecosystem approach" to managing fish stocks, along with better models of how both interactions between species and overall ecosystem health affect sustainable yields. Crude models of marine ecosystems have been kicking around for years, but they generally aren't sophisticated enough to apply to commercial fishing, says Michael Sissenwine, senior scientist at the National Marine Fisheries Service (NMFS), which collects and processes data on U.S. fish stocks. The report notes that improving the models will require better data on such human impacts as the extent of "bycatch"—creatures caught accidentally in the nets of trawlers.

Sissenwine agrees that there's a need for more research, but he notes that better models and surer estimates of optimum fishing levels won't help if managers don't use the information. But he does see a bright spot for the ecosystem approach. "People doing research now will increasingly advance to management positions," he says. In time, the managers may not need any persuading.

—Richard Stone

*"Improving the Management of U.S. Marine Fisheries," NRC, May 1994.

job of following scientists' recommendations in setting strict catch limits. As a result, many Alaskan fish populations such as Pacific halibut and salmon are still in good shape. And a moratorium on striped bass fishing in the mid-Atlantic states during the 1980s has allowed that fishery to rebound strongly from historic lows early in that decade.

These successes are encouraging scientists to change their approach in the fight over fishing limits, Rosenberg says. Many are now becoming more outspoken in arguing for conservative catch limits even when the data are uncertain. They've also learned a political lesson, Rosenberg says—the value of involving more members of the fishing industry in the stock-assessment process, "so people don't think we're doing something dark and mysterious." In addition, he notes, NMFS has begun to include economists in its analysis groups to evaluate the economic effects of various management strategies, thereby bolstering its claims that, in the long term, tighter regulation will benefit fishers.

Such regulation, say fisheries experts,

might take the form of limits on the overall catch or of quotas assigned to individual fishers, which could be bought or sold. However the fishing pressure is eased, examples such as the striped bass suggest that fish populations can recover from even severe overfishing. Most biologists are reluctant to venture a guess as to how fast, though, because the speed of recovery also depends on the lifespan and reproductive rate of the fish—and the environmental vagaries that affect them.

Yellowtail flounder, for example, only reproduce well in years with cold winters. "Now what can we do about cold winters? If we don't have cold winters for the next 10 years, there won't be any yellowtail," says fishing-boat owner Barbara Stevenson of Portland, Maine. For her and other beleaguered fishers looking for a better future, therefore, the key words appear to be restraint—and patience.

—Bob Holmes

Bob Holmes is a science writer in Santa Cruz, California.

NOTICE

NOTICE

The Virginia Marine Resources Commission invites public comment on proposed regulations for the blue crab fisheries in Virginia tidal waters. The purpose of these proposals is to continue to protect and conserve the blue crab resource so that sustainable yields may be realized for the many blue crab fisheries. Public comment is not limited to these regulatory proposals but is requested by the Commission so that it may determine whether or not any of these or other alternative regulatory proposals should be adopted as conservation measures.

CRAB DREDGE FISHERY:

1. Establish the number and size of crab dredge gear to be used during the 1994/95 season.

HARD CRAB POT FISHERY:

1. Establish open and closed seasons and corresponding time periods for the taking of hard crabs.
2. Require cull rings in hard crab pots and determine the size of the cull rings.
3. Establish time periods and areas for cull rings to remain open.
4. Require a five (5) inch minimum size limit for all hard crabs, male, female, and immature female, in combination with the requirement for each hard crab pot to contain two 2 3/16-inch cull rings, and
5. Adjust the current time-of-day limitations on crabbing.

PEELER POT, POUND OR TRAP FISHERY AND SOFT CRAB INDUSTRY:

1. Establish open and closed seasons and corresponding time periods for the peeler pot fishery.

2. Establish a minimum size limit for peeler or soft crabs.
3. Require cull rings in peeler pots, peeler traps or pounds and determine the number, size and location of the cull rings.
4. Establish limits on the number of peeler pots that may be set at certain times of the year and on the number of licensed peeler pot fishermen per boat.

In addition to the above options, the Commission requests comments on the following regulatory proposals.

1. Limit or restrict the taking of sponge crabs.
2. Establish additional sanctuaries or expand the current sanctuary. This management option could be used in combination with, or in place of, the above regulatory proposals to achieve conservation.
3. Amend Regulation 450-01-0093 to delete Section 3.C. which authorizes the Commissioner to allow crab pot cull ring closures for specific times and in specific areas.

A Public Hearing on the above proposal is scheduled as follows:

Monday, October 24, 1994, at 7:00 PM in the Newport News City Council Chambers, 2400 Washington Avenue, Newport News.

Any interested person may present testimony. Written comments should be forwarded to Jack G. Travelstead, VMRC, Box 756, Newport News, Virginia 23607-0756.

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