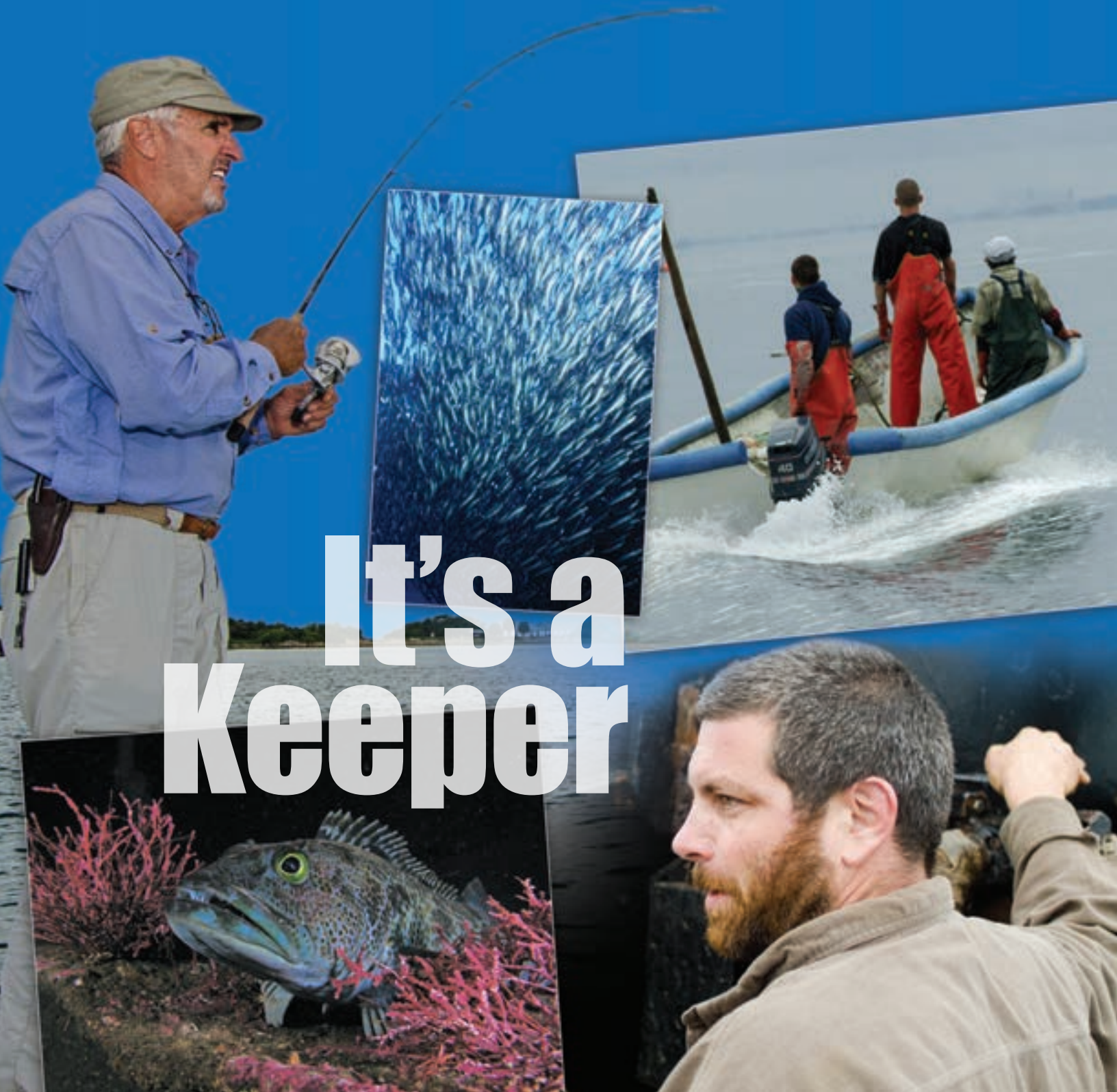
The Law That's Saving American Fisheries

The Magnuson-Stevens Fishery Conservation and Management Act



It's a Keeper

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Foreword

Implementation of the Magnuson-Stevens Fishery Conservation and Management Act has come a long way since the law was first enacted in 1976 to secure viable fisheries and healthy oceans. Initially, provisions to "Americanize" our fisheries through government subsidies and other programs worked well—too well, actually—so that by the late 1980s, some of our iconic fisheries, among them New England cod and Gulf of Mexico red snapper, were severely overexploited. To address these problems, fishermen, environmental groups, congressional leaders, and others came together to improve the law, resulting in what is now one of the best fisheries management systems in the world in terms of profitability and sustainability.

I was fortunate to be part of this process during my seven years as director of the National Oceanic and Atmospheric Administration's Fisheries Service. I consider the 2006 reforms, which resulted in requirements for science-based catch limits to restore and maintain fish populations at healthy levels, to be one of the crown jewels of our fishery management system.

What follows are the stories of fishermen who have helped to shape the law into what it is today through direct engagement in the policy process, on-the-water ingenuity, and entrepreneurial spirit. They talk about their hard work and foresight as well as the economic benefits that are beginning to accrue as we turn a corner on our decades-long battle against overfishing.

As we reexamine the law and look forward to the next reauthorization, I encourage you to consider the hard-won gains described in this report—progress based on learning from the past, listening to the science, and putting the sustainability of the resource at the forefront. Ensuring the long-term productivity of our fisheries requires us to protect these gains while continuing to promote new and innovative solutions to the problems that our oceans face from myriad stressors, including increasing atmospheric carbon and temperature.

For the benefit of the nation, we must therefore continue to evolve U.S. fisheries policy, invest in science and technology, and strengthen cooperative research programs to meet the challenges that lie ahead. Doing so will ensure that we can continue to boast one of the best fishery management systems in the world.

Bill Hogarth
Director, Florida Institute of Oceanography
Former director, National Oceanic and Atmospheric Administration's Fisheries Service

I. Introduction and summary



Cod—shown drying in Gloucester, MA, in the 1800s—were abundant in New England in the 19th century, but by the 20th century, they were severely overexploited.

NOAA

For more than 200 years, the catch of important fish such as cod and bass, sardines and salmon, and oysters and clams helped America build ports, communities, and industries. These historic fisheries contributed not only to the nation's food supply but also to its economy, culture, and trade. Individual states regulated local fishing fleets, but their authority generally ended three miles from shore, far enough to oversee coastal fishing. The federal government had more pressing concerns than policing the millions of square miles where fishermen, frigate birds, and whales plied the waters.

Prosperity after World War II ushered in a golden age for America's commercial and recreational fishermen. The former had a hungry nation to feed and faced few competitors as the world recovered from the conflict. Recreational fishermen exerted their influence beyond freshwater with the dawning of the sportfishing industry, trailerable boats, and advanced fishing gear.

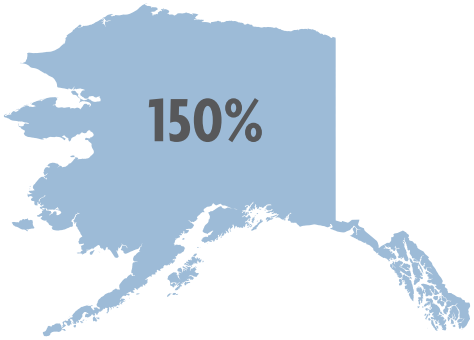
But America was not the only place where the engines of technology thrust fishing into the 20th century and far beyond nearshore waters. Bigger, faster, more powerful foreign factory ships arrived by the hundreds and began emptying the ocean's larders off U.S. shores. Fishing industry leaders from regions such as New England, the Pacific Northwest, and Alaska turned to their representatives in Congress for measures with a longer reach than states' three-mile jurisdiction. They had seen proof that modern fishing methods could deplete oceans that once seemed inexhaustible. It was time to bring the rule of law to the open sea.[1]

In 1976, with the passage of what is now known as the Magnuson-Stevens Fishery Conservation and Management Act—led by Senators Warren Magnuson (D-WA) and Ted Stevens (R-AK)—the United States took charge of all that swims, scuttles, and tastes good in the world's largest exclusive economic zone: 3.4 million square miles of sea.

A generation of determined, farsighted commercial and recreational fishermen, marine scientists, and legislators shaped that law. They brought to it lessons learned the hard way, based on principles that are simple and sound. They believed that the nation's rich fishing grounds could feed generations of Americans far into the future, but only if catches were well-controlled.[2] Many of them knew that it would pay off to leave enough fish in the water to regenerate healthy stocks in the future.

But politics is the art of the possible, and the law in its original form was well-designed but not watertight. U.S.

fishermen were developing the technological power and capacity to wear down fish populations, and in many places they did. It would take another generation to plug those leaks.[3]



Increase in value of Alaska seafood exports, 2000-2011[a]

Over time, some of the wisest minds on the waterfront helped to close loopholes in the law that allowed more fish to be caught than the oceans could replenish. In 1996 and 2006, procedures were strengthened for setting and enforcing limits on catches. The result: a turnaround in American fisheries. T.J. Tate, executive director of the Gulf of Mexico Reef Fish Shareholders Alliance, put it this way: "The science is showing the stocks are coming back. We're doing the right thing. But it takes hard work, it takes time, and it takes effort and energy. If you look at what the Magnuson-Stevens Act is doing for fisheries for all of America, I don't think you can discredit that."

The stories that follow in this report show how fishermen and resource managers learned to get it right. Success in managing and rebuilding America's fisheries ranks among the leading achievements of marine resource management in the world.[4]

U.S. fishermen applied their ingenuity in solving problems, and those who demonstrated leadership prospered. This collection of stories highlights pioneers of American fishery management as well as innovators who are opening fishing frontiers, revealing:

- How a salmon fishing pioneer's courage in making sacrifices for long-term sustainability set the stage for Alaska's success.
- How successful fishermen from Alaska to Florida used discipline to turn around two decades of overfishing.
- How West Coast trawlers found the flexibility to make a living within rebuilding programs.
- How fishing entrepreneurs in Port Clyde, ME, turned leadership into opportunity.
- Why rebuilding important recreational species such as summer flounder, bluefish, and lingcod provides economic as well as enjoyment payoffs.
- What commercial and recreational fishermen believe we get from good stewardship.

These personal stories demonstrate why U.S. fishermen in many fleets (though not yet all) are prospering while many foreign rivals falter. The best-managed U.S. fisheries enjoy growing exports and rising incomes for fishing businesses, reduced discards of unusable fish caught in error, and dramatic improvements in the efficient use of our marine resources. Some fisheries are producing more seafood products per pound of fish caught than ever before.[5] U.S. fishermen and scientists are recognized as world leaders in the development of tools for avoiding bycatch (the incidental catch of nontarget species) and protecting marine habitats.

The Magnuson-Stevens Act laid the foundation for a thriving American seafood industry and for recreational fishing and tourism sectors that are the backbone of many coastal economies. The ingenuity and sacrifice of those who built this industry over time have resulted in the domestic harvest, export, distribution, and retailing of seafood in America that generates more than $116 billion in sales and employs more than 1 million people.[6] Recreational fishing adds nearly $50 billion and more than 327,000 jobs to that total.[7]

Critics of U.S. fishery management want things to be easier right now; they are not willing to invest in the long haul. Taking a look at the history of our management and what it has achieved is helpful in the face of such criticism. That history is the story of fishing people who saw beyond the end of their own docks, who were willing to work for a better tomorrow.



Value of Atlantic sea scallops in 2010[b]

That same commitment to the future sustainability and long-term profitability of our nation's fisheries will be needed when Congress reauthorizes the Magnuson-Stevens Act. We know that success requires a focus not just on economically important populations of fish, but also on interrelated species and larger ocean ecosystems

[a] Calculated from 2011 export charts from Alaska Governor Sean Parnell and accompanying release of April 13, 2012, "Alaska Exports Reach Record Highs," http://gov.alaska.gov/parnell/press-room/full-press-release.html?pr=6097.

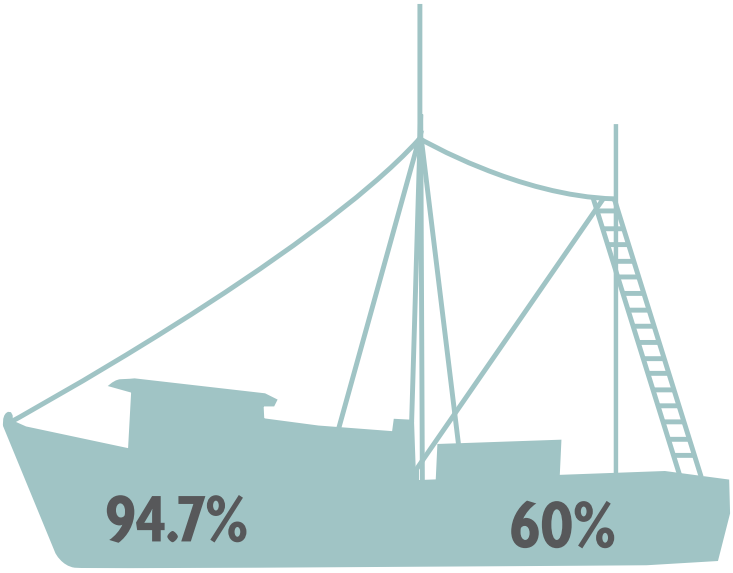
[b] http://www.fishwatch.gov/seafood_profiles/species/scallop/species_pages/atlantic_sea_scallop.htm

that support viable fisheries. Ending overfishing is just the beginning of sustainable fisheries management.

In this broader, ecosystem-based approach, catch limits are one important component. Changes in water quality from upland uses, weather, and accidents such as oil spills can affect spawning adults and recently hatched juveniles. Coastal development, done poorly, can harm marshes, estuaries, and similar habitat types that are critical at certain life stages of marine fish populations.

Then there is global climate change. Scientists predict that as ocean waters warm, more fish will move toward the poles and to deeper waters, thereby affecting the availability of many of the fish valued by recreational and commercial fishermen. Fishery managers cannot control these events, but they can account for them as part of an overall ecosystem approach to fishery management.

In short, Congress needs to ensure that fisheries managers have the tools necessary for successfully ensuring the long-term viability of our nation's fisheries and coastal economies.



Reduction in discards of unusable fish in the Bering Sea/Aleutian Islands pollock fishery, 1998-2010[d]

Increase in usable product brought to market per ton of pollock caught in the Bering Sea/Aleutian Islands pollock fishery, 1998-2010[e]

When reauthorizing the Magnuson-Stevens Act, Congress should consider amendments that would:

- Minimize the habitat damage and bycatch of indiscriminate fishing.
- Ensure that adequate forage fish are left in the water to feed the larger ecosystem.
- Promote decisions founded on ecosystem-based fisheries management.

The future is full of promise if we remain vigilant in pursuing science-based management. U.S. fish populations are recovering, and the global seafood market is growing. America's investment in top-notch fishery science, and its commitment to a responsible management system to translate that science into sound policy and decision-making, will add billions of dollars to our economy, support hundreds of thousands of jobs, and contribute to the well-being of coastal communities and the people who depend on a healthy coastal environment for their livelihood.

That's a pretty good catch. As many fishermen would say, it's a keeper.



Increase in quota for Gulf of Mexico red snapper, 2009-2013[c]

[c] Calculated from the Framework Action to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico, 2013.

[d] Calculated from data presented in "Fishing for Pollock in a Sea of Change," by James Strong and Keith Criddle, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, April 2012 (p. 106).

[e] Ibid.

II. Hard-won lessons built America's resolve



The seiner Sea Gypsy brings up a bag of salmon outside Ketchikan in southern Alaska. ALAN HAIG-BROWN

After the depletion of important U.S. fish populations, including fishery collapses, fishing and congressional leaders built the legal framework to defend the nation's invaluable resource. They made the Magnuson-Stevens Act tough—and tightened it up—for good reason: Tough works.

When Clem Tillion settled in Alaska after World War II, he found out what happens when government ducks the hard decisions that keep fisheries healthy. He became one of many citizens of the northern territory who fought successfully for statehood so that they could start fixing the damage. They made sacrifices to restore broken-down salmon populations, enduring years of closures that cut into their primary livelihood. It was gritty, common-sense conservation.

And it worked. Fish stocks struggled back to health, then roared to new peaks, and Alaskans prospered as never before. Along the way, Tillion joined a generation of coastal leaders who knew firsthand that rigorous controls on catch were the only way to protect the resources that would feed their children and grandchildren.

Those hard-earned lessons would eventually become the backbone of Alaska's famously abundant modern fisheries—and the reason so many American fisheries are on the mend today.



Clem Tillion lived through Alaska's postwar salmon fishery collapse and helped win the fight to restore the population. LESLIE MORAVA

Clem Tillion

The courage to keep fisheries healthy

After serving in the Pacific during World War II, Clem Tillion went north to homestead on the cold, plentiful waters of Alaska's Halibut Cove, across the bay from Homer. He fished, married a gold miner's daughter, and started a family. Halibut and salmon provided their living. "We ate fish four out of five meals," he recalled years later. "It was all I could afford."

Tillion was dismayed to discover that Alaska's vast salmon runs were collapsing. Under lax territorial rule, the absentee corporate owners of canneries ignored dire warnings and kept pulling fish from Alaska's salmon rivers, mainly with company-owned fish traps that dominated the catch. Hungry and discouraged, some Alaskan fishermen had turned to creek robbing. Whole towns' futures were in jeopardy because of corporate fish traps and poachers.

"By the late 1950s, nearly all the salmon fisheries were down to just a ghost of their past," Tillion recalled later. Alarmed by the collapse, President Dwight D. Eisenhower had declared parts of coastal Alaska to be federal disaster areas in 1953. Still, Alaska's salmon catch slipped to 25 million fish by 1959. It was the lowest harvest in 60 years—from four times the number of fishermen as in 1900—and a humbling drop from the average annual catch of 90 million fish in the 1930s.

That dark year was a turning point. After decades of struggle for autonomy, Alaskans achieved statehood in 1959, gaining the chance to try to reverse the spiraling collapse. They immediately abolished fish traps, which had become hated symbols of unsustainable corporate extraction. It was no coincidence that Alaska's new constitution explicitly required "sustained yield" management of fish and wildlife, a historic first.

Calling the revival of Alaska's commercial fisheries "an absolute imperative," Governor Bill Egan appointed Clarence Anderson, a man whom Tillion admired deeply, to drive the

revival. Anderson turned the governor's charge into a gospel of tough love in fishery management. Decades later, Tillion often recounted the mandate that Anderson delivered to his management biologists, several of whom were regular guests at Tillion's dinner table: No matter what, they must ensure that enough salmon escaped capture to spawn and restore abundant populations.

Tillion's fishing opportunities were curtailed to restore the runs. His net hung dry in the loft, and he was forced to find work on shore and in other fisheries. But like many other Alaskan fishermen at the time, he knew that the medicine was necessary. They weren't just enduring catch restrictions; they were fighting for their future.

And they succeeded. By 2011, Alaska's 10-year average landings of salmon amounted to nearly 171 million fish, about half from the wild and the other half from hatcheries. The state's tight but flexible regime of escapement goals protected spawners. In-season closures, limited fleet size, and rules governing gear, locations, and times of fishing became a model for responsible fishery management, especially for stocks that spawn in rivers but swim out to sea to grow.

"Don't put me between you and the fish, because I'm going to vote with the fish."

—Clem Tillion

The restoration of Alaska's salmon became a training ground for Tillion and many other fishermen and managers. In Tillion's case, one big lesson came early. He found that politics was too important to leave to the powerful; it was a skill as essential as fishing for a man with a family to feed. He won a seat in Alaska's Legislature, served nine terms as a state lawmaker, and rose to become president of the state Senate, an adviser on ocean policy to President Richard M. Nixon, and a formidable force in the nation's fish politics.

Fiery and sure-footed, Tillion staunchly defended Anderson's dictate to ensure adequate spawning escapements. He became known for telling his constituents, "Don't put me between you and the fish, because I'm going to vote with the fish." Tillion also led the bitterly contested fight to limit the number of salmon fishermen, establishing a permit system designed to prevent a surge of new entrants from wearing out salmon populations that Alaskans were rebuilding.

These positions were often unpopular, but Tillion's policies endured because they worked. To this day, Tillion advises lawmakers to remember that the nation's fish are not an entitlement for today's resource users. They are a legacy. Now a great-grandfather, Tillion believes that his grandchildren and their grandchildren "have a right to have a good run of fish."

The unyielding lessons of Alaska's salmon disaster taught Tillion and other Alaskan leaders of his era to stand firm for the principles of sound renewable-resource management. They brought that hard-won wisdom to a national debate over how to govern fishing far beyond the coast.

Shaping America's fishery law

Until the 1960s, fishing rules were mostly up to the states to set within their waters. Their jurisdiction ended three miles from shore, with rare exceptions in which a few states reached a few miles farther. The ocean beyond was nobody's business: open country with no sheriff. Plenty of fishermen liked it that way, but most of them soon changed their minds.



PATRICK DIXON, WWW.PATRICKDIXON.NET

Rob Ernst prepares to throw a sockeye salmon into a nearly full fish hold on the Veronika K in Alaska's Cook Inlet.

What made law and order suddenly attractive—and transformed the nation's conception of the open sea—was a new threat to fishermen's livelihoods and the resources that supported them. Armadas of factory trawlers and other distant-water fishing vessels arrived from Asia and the Soviet bloc. Many of them were bigger, faster, and more advanced fishing machines than anything in the American fleet. They began emptying the ocean a few miles off the coast—often within plain sight of vacation homes and fishing harbors on the East and West coasts.

"All management should be for the generation coming, not for the generation that's here today. If all you can think about is your own next year's payments instead of what your grandchildren and great-grandchildren will have, then your grandchildren will have nothing to worry about: There won't be anything left."

—Clem Tillion

Like many other fishermen in New England, Jake Dykstra saw his livelihood being hauled away by the new ships from overseas. A longtime spokesman for the Port Judith, RI, fleet, he later summed up the encounter for The Boston Globe: "After the trawlers came, if you happened to be somewhere when they descended on you, two days later there were no fish. We didn't believe it could happen." Dykstra became one of the most effective and revered participants in the struggle to push out the foreign fleets.

He and Tillion knew that the responsibility would be immense. If America asserted its authority over fisheries out to 200 miles from shore, as many insisted it should, was the nation prepared to manage and conserve marine fisheries across millions of square miles of ocean? At the time, many doubted whether this vast new realm could be patrolled. Nor was it certain that scientists could reliably estimate the size of fish populations in order to recommend sound limits on catch.

The debates were epic. In international and domestic political forums, Tillion, Dykstra, and other fishing leaders joined a vigorous discourse with peers, scientists, and politicians from around the world.

Tillion, ever the master of the long view, argued that America should cap the growth of its fleets and set hard catch limits from the start. That way, as U.S. vessels took over resources from the foreign operations, they could expand to only so many vessels and so much catch. "Start getting ready to close the doors while you've still got breathing room to do it," he urged. Tillion hoped U.S. fishermen could avoid the pain that occurs when fleets outgrow the resource: bankruptcies, restrictions on catch, and the difficult decision to reduce the number of people plying the water for fish.

Dykstra took the opposite view. Capping American fleet size would impose "a regulatory nightmare which places unfair constraints on U.S. fishermen," he told a 1978 conference on ocean policy.[8] To him, the right of the individual to fish is fundamental; if this makes fishery management difficult, so be it. For decades, Dykstra's approach prevailed regionally in New England, although it was amplified by political forces that weakened controls on fishing even further. Tillion's approach prevailed in Alaska, and eventually nationwide.

Until very recently, New England clung to unlimited participation. Fishery managers in the region rejected hard catch limits, instead embracing "input" regulations such as a limit on how many days at sea a boat could operate, as well as trip limits designed to slow removals without setting a hard cap on the catch.

In Alaska, Tillion and other leaders insisted on tighter controls. They strictly limited catches, monitored them using onboard observers, and eventually capped the number of fishermen allowed.

The divergent track records of New England and Alaska eventually became an object lesson: collapse and painful cuts in the Northeast, versus a steady diet of carefully restrained limits that rebuilt and maintained many strong fisheries in the North Pacific.

Recently, however, Dykstra's successors in New England fisheries have embraced Tillion's approach. Catch limits are in effect through a congressional mandate. They have begun to limit fishery participation—and maximize earnings—through sector management, in which 97 percent of the total catch is allocated among cooperatives of fishermen.

No one says these changes are easy, and not everyone wins. New generations of New England fisheries leaders are earning the same battle scars that Tillion and some of his peers acquired long ago in Alaska. Over time, those scars became badges of honor. As Tillion puts it, "If you think you're going to be a hero in this game, you've got to live a long time before your enemies pass on."

The tension between long-term resource management and the individual's right to fish still resonates in U.S. fisheries. It



Fishermen in southeastern Alaska dump salmon from a fish trap into a scow for transport to a cannery in a photograph taken sometime before 1959, the year Alaska became a state. After admission to the Union, Alaska took control of salmon runs and created a stringent and sustainable fishery management system.

DORA M. SWEENEY/ALASKA STATE LIBRARY

probably always will. These days, the ancient contest is probably sharpest among saltwater recreational fishermen, who are now a powerful force on the waterfront and in Congress.

Some sportfishing leaders used their influence to strengthen stewardship of fishery resources for all. George Geiger, a Florida guide who chaired the state chapter of the Coastal Conservation Association and served on the South Atlantic Fishery Management Council (including two years as chair), waged a successful struggle to end chronic overfishing of several depleted populations. Unfortunately, some other sportfishermen have not learned the hard lessons from past fishery collapses. Invoking the individual's right to fish, they insist that they should be allowed to catch more, that limits recommended by scientists amount to a wild guess, and that accountability is necessary only for someone else.

For lawmakers who must sift the substantive claims from the merely self-serving, it would be difficult to find a more reliable voice of experience than Clem Tillion's. His advice? "All management should be for the generation coming, not for the generation that's here today," he says. "If all you can think about is your own next year's payments instead of what your grandchildren and great-grandchildren will have, then your grandchildren will have nothing to worry about: There won't be anything left."

THE 35-YEAR BATTLE TO END OVERFISHING

The drafters of the Magnuson-Stevens Fishery Conservation and Management Act[9] wanted more than an end to overfishing (taking fish faster than they can reproduce) by foreign fleets in U.S. waters. They also wanted to rebuild stocks so that American fishermen could prosper.[10]

In order to involve fishery participants in the management process, the authors created a system of eight regional fishery management councils. Fishing stakeholders from diverse communities, sectors, and interests are nominated by governors to serve on the councils. These bodies develop plans and recommend management measures, which are then approved by the U.S. secretary of commerce and promulgated as regulations.

For the first 20 years of U.S. fishery management, the law broadly mandated that the councils prevent overfishing. But neither the law nor agency guidelines included a specific and effective set of tools for ensuring that the councils or the National Oceanic and Atmospheric Administration's Fisheries Service actually halted the practice. Without a clear requirement for firm catch limits, accountability measures, or action in keeping with scientific advice, chronic overfishing reached crisis proportions in many U.S. fisheries.

By the 1990s, coastal communities faced depletion of important fish populations, including New England cod and yellowtail flounder; mid-Atlantic summer flounder; Gulf of Mexico red snapper; Pacific coast rockfishes; and swordfish.

The Sustainable Fisheries Act of 1996 attempted to tighten the restriction on overfishing by requiring councils to establish an objective definition of overfishing in each fishery management plan.[11] But the changes, together with the decisions of officials implementing the new requirements, still allowed overfishing to continue in far too many instances. Managers often failed to set limits or ignored scientific advice in setting them. And, most importantly, there was little accountability if catches exceeded limits. Ten years after passage of the mandates, overfishing was still a big problem.

It would take another decade, and recommendations from two blue-ribbon panels created to assess the health of America's oceans, before Congress took decisive bipartisan action to address the shortcomings in the Sustainable Fisheries Act.[12] The failure to end overfishing fueled the debate over fishery management in 2006, and the clear intent of Congress in the Magnuson-Stevens Act reauthorization that year was to end overfishing by requiring catch

Evolution of provisions to secure sustainable U.S. fisheries

Fishery Conservation and Management Act of 1976

- Declared 200-mile fishery conservation zone.
- Created regional council system
- Called for sustainable management that would prevent overfishing
- Gave councils authority to modify maximum sustainable yield "by any relevant social, economic or ecological factor."

Sustainable Fisheries Act of 1996

- Set maximum sustainable yield as a limit but disallowed overfishing for economic or social reasons
- Required management plans to define overfishing using objective and measurable criteria
- Called for annual report on status of stocks
- Established deadline for ending overfishing and rebuilding depleted populations, with some exceptions

Magnuson-Stevens Reauthorization Act of 2006

- Mandated annual catch limits in management plans
- Required councils to heed recommendations of scientific advisers
- Added requirement for accountability measures to ensure that objectives are met
- Required managers to end overfishing within two years

limits in all U.S. fisheries and enforcing those limits through accountability measures.[13]

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 built on those reforms and strengthened them by adopting key recommendations of the Pew Oceans Commission and the U.S. Commission on Ocean Policy. The reforms require councils to specify annual catch limits and accountability measures, and require scientific advisers to make fishing-level recommendations that serve as the upper limit on the annual catch.

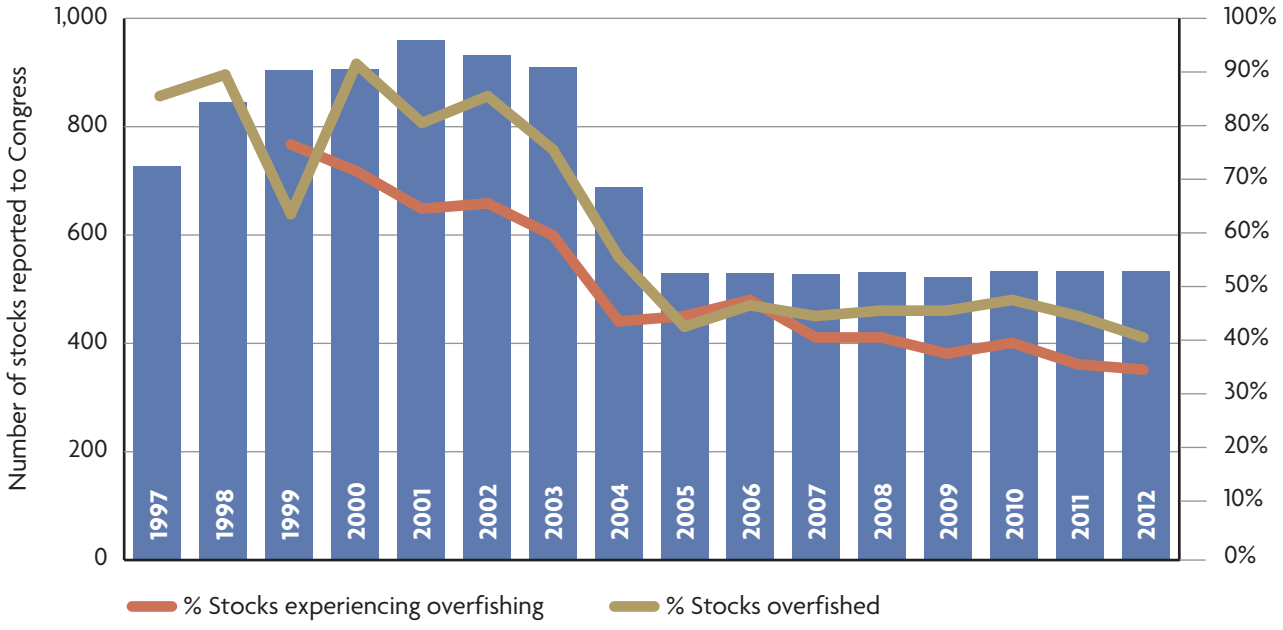
Ending overfishing is important not only to preserve species, populations, and marine ecosystems but also to preserve future opportunities for fishing communities to maintain their livelihoods. The economic benefit of commercial fishing for coastal communities is well-known, but the effect of recreational fishing on these communities has become increasingly important in economic value, number of participants, and level of landings.[14]

Ensuring the sustainability of this public resource is critical for recreation and food. Allowing U.S. fisheries to realize their potential while avoiding overfishing yields value in revenue, exports, jobs, recreation, and other economic activity.

Of the 245 species whose overfished status was reported as "known" in the 2000 edition of the NOAA Fisheries Service's Status of Stocks, 92 of them, or 38 percent, were classified as overfished (at a level unable to support maximum sustainable yield). Similarly, 72 stocks, or 26 percent, of 282 reported as known were experiencing overfishing in 2000. By the time the Magnuson-Stevens Act was reauthorized in 2006, 25 percent of the known reported stocks were still overfished, and 20 percent were still experiencing overfishing.

Ending overfishing represents the fulfillment of the vision of 1976. In the words of Sen. Stevens in 2003: "Senator Magnuson and I, when we first introduced this bill, agreed on one goal: This bill was not a bill to protect fishermen; it was not a bill to protect jurisdiction of states; it was to protect the reproductive capacity of our fisheries. And I think that should continue to be the goal as we go forward."

Status of U.S. fish stocks, 1997-2012



III. Turning the corner on overfishing



Red snapper in the Gulf of Mexico have rebounded in the past five years because of measures that have helped to end overfishing.

NED DELOACH

The red snapper fishery has a long history in the Gulf of Mexico. Commercial fishing, which began in the middle of the 19th century, and recreational fishing, which started in the 1950s, contributed to a steady decline in red snapper abundance. In addition, shrimp trawls took millions of juvenile red snapper as bycatch. The population was assessed as overfished in 1988, and catch limits were set in 1990. These limits were exceeded regularly, however, and bycatch reduction devices did not lower the amount of red snapper killed by shrimpers as much as anticipated.

Rebuilding deadlines were postponed, and fishing limits were set higher than scientists recommended. By 2006, the population of mature red snapper was estimated to be less than 3 percent of historical levels. The next year, a federal court ruled that fishery managers were using flawed logic, not science, and ordered changes. Five years later, these new rules not only ended overfishing of Gulf red snapper, but they also led to a steady increase in allowable catch.

As the Southeast continues to grapple with the legacy of chronic overfishing on many of its important species, red snapper in the Gulf of Mexico serves as a testament to the effectiveness of setting and sticking with firm limits.



George Geiger, a Florida fisherman who served on the regional management council, worked to implement catch limits in the face of strong opposition.

BRIAN GAUVIN, WWW.GAUVINPHOTO.COM

George Geiger

Stay the course

"It takes a strong backbone to protect and rebuild fisheries," says George Geiger.

The avid Florida angler and retired Army officer served three terms on the South Atlantic Fishery Management Council, ultimately as chairman, where he led a long battle to reverse the corrosive consequences of overfishing. He faced down angry friends and colleagues to implement hard catch limits and accountability measures mandated by Congress in 2006, when federal lawmakers confronted the erosion of America's marine fisheries and, in Geiger's words, "closed the loopholes that allowed overfishing to continue for decades."

Success in fishery management is measured in fish, not votes or friends. Although progress will take time, several of the region's fish are showing early signs of recovery. While many sportsmen and their elected leaders dispute the scientific rationale for catch limits and push legislation to relax them, the tough new policies are beginning to pay off.

After decades of overfishing and lax management, prized black sea bass in the South Atlantic are showing increases in average size and in the population's reproductive potential, which has risen by 44 percent since its low point in 1995.[16] Thanks to stronger accountability measures, black sea bass finally have a chance to replenish, promising greater abundance and larger catch in future years.[17]

These aren't trivial accomplishments. The improving vital signs in the black sea bass fishery reflect a turning point in the long struggle to bring it back to health. The council tried twice before to rebuild this species, but without firm or enforceable catch limits, fishing effort swelled and catches rose far beyond sustainable levels. The 2006 reauthorization of the Magnuson-Stevens Act provided the impetus to reverse this failure, including "accountability measures to make sure the catch limits were not exceeded," Geiger notes. Now, he says, the latest assessment and catches suggest strongly that black sea bass "is finally making a recovery after more than two decades and two failed rebuilding plans."

The tools provided in the 2006 federal amendments, including a requirement for annual catch limits and accountability measures if those limits are exceeded, have enabled Geiger and other council members in the South Atlantic to begin reversing the destructive pattern of uncontrolled fishing that haunted the region for decades. Starting with only two stocks under meaningful catch limits, the South Atlantic council systematically placed managed species under limits to end and prevent overfishing by the end of 2011.

Success in fishery management is measured in fish, not votes or friends. Geiger's success is swimming in the waters of the South Atlantic and showing up in improved catches.

Many anglers blamed Geiger for administering the bitter medicine. But his own experience on the water and in fishery management motivated him to stand firm. After his Army career, Geiger dreamed of retiring to the fisherman's cornucopia he knew in the early 1970s, when he was stationed at Daytona Beach, FL. By the time he left the service in 1986, overfishing had taken a heavy toll, however. "Fishing had deteriorated to such a degree, I became incensed," he says.

Geiger, an active fishing guide and charter operator, wasn't about to sit on his hands. He plunged into advocacy through the Coastal Conservation Association, rising to become its Florida chair. But he stepped into the hot seat in earnest when he accepted an appointment to the South Atlantic Fishery Management Council, which is responsible for crafting the rules governing fishing for 98 species in the 200-mile zone off the southeastern coast.

Geiger was pleased to see that national Coastal Conservation Association leaders initially welcomed the tough new overfishing mandates of the 2006 Magnuson-Stevens amendments. He recognized the law as a chance to get a grip on a slippery, chronic problem.

Geiger took plenty of heat for doing the necessary work. Even seemingly staunch supporters of sound resource management lost their resolve when the restrictions began to limit their own opportunities, Geiger says. Many disputed the science underlying the new catch limits. Geiger, who knew the data sources and the real challenges faced by stock assessment scientists, stood by the science. He realized that total certainty in science is rare, but perfect knowledge isn't required to avoid wrecking fisheries.

In 2011, Geiger testified before the fisheries panel of the U.S. House Natural Resources Committee, urging lawmakers to stay the course on the new catch limits and affirming that those limits are founded in sound science. "Implementing catch limits now is a prudent, sensible, and necessary approach to finally get severely depleted species back to healthy levels and ensure that we don't make the same mistakes of the past," he told the panel.[18]

It's true that the science underpinning fishery management can and should be improved, Geiger argues, but real improvement won't be achieved by shrugging off the difficult job of setting catch limits. Strengthening the scientific basis of management requires steady investment in training stock assessment scientists, conducting surveys, and gathering data through cooperative research with fishermen and independent investigators, and a willingness to keep asking tough questions. These steps are under way.

It may be daunting, but Geiger believes that ending overfishing is both urgent and achievable. What's needed now is resolve. As he told the House panel in 2011: "The conservation measures we've nearly finished putting in place in the South Atlantic and around the country are going to work." Indeed, they are already working, as the South Atlantic council's progress shows. In his written testimony, Geiger exhorted members of Congress to recognize that "those improvements in abundance are due to successful, science-based management."

He added, "Now is not the time to backpedal and return to the ineffective management practices that existed before the 2006 reauthorization of the MSA and resulted in depleted stocks."



After decades of overfishing, black sea bass in the South Atlantic are recovering. NOAA

IV. Science-based limits with accountability work



A federal fishery observer examines baskets of accidental catch on a vessel targeting rockfish and sablefish off the West Coast.

NOAA

Since the establishment of annual catch limits and accountability measures for nearly all federally managed fisheries in the United States, the evidence is mounting that we are on the way to ending overfishing and rebuilding and sustaining fishery populations.

When NOAA Fisheries released the 15th annual Status of Stocks report to Congress in May 2012, the agency reported a record number of stocks rebuilt in 2011, with a decrease in the number of stocks being overfished and experiencing overfishing.

Of the 46 fishery management plans covering 537 stocks, annual catch limits were implemented in more than 40 plans by the end of 2011, and in all by the start of the 2012 fishing season. Some stocks, such as salmon, shrimp, or species covered in ecosystem plans or managed by international agreements, are not required to have annual quotas.[19]

Science-based limits, combined with accountability to ensure that catches are consistent with restrictions, get results. The use of science-based limits is not a new idea; it has long proved effective for managing fisheries and rebuilding populations. Analyses from cases all over the world show that fish populations rebound when excess fishing mortality is reduced. Of 24 depleted stocks worldwide with formal rebuilding plans to reduce excess fishing mortality, all but one recovered.[20]

As with any change, the transition to annual catch limits has not been without challenge, particularly in fisheries where chronic overfishing was the rule rather than the exception. But many fishermen have figured out how to make the system work.



David Krebs, who fishes for red snapper in the Gulf of Mexico, says "it was really tough fishing" until catch limits helped to launch the population's recovery.

BRIAN GAUVIN, WWW.GAUVINPHOTO.COM

David Krebs

Red snapper fishermen earn 'conservation returns'

After lobbying to reduce their catch limits a few years ago to speed red snapper recovery, Gulf of Mexico commercial fishermen earned a conservation return in 2012: The allowable catch climbed 7 percent to just over 8 million pounds, the fourth year in a row that an increase occurred.

"Fishermen should continue to see bigger fish and larger catches as the population rebounds," said Sam Rauch, NOAA's fisheries director, in announcing the increase.

Giving the fish a break helped the fishery climb out of trouble. "By the time we got to the 2006 season, we could barely fill the commercial quota. It was really tough fishing," says David Krebs, past president of the Gulf of Mexico Reef Fish Shareholders Alliance.

The snapper population was in rough shape at the time. Heavy fishing pressure, including the losses of juveniles taken as bycatch, had taken a toll. Red snapper was officially classified as overfished in 1988; disputes over how to rebuild it went on for more than a decade, eventually reaching the courts. The Coastal Conservation Association, representing recreational anglers, sued to reduce bycatch of snappers in shrimp trawls, and efforts to reduce that incidental impact continue today.

Meanwhile, commercial fishermen in the alliance figured it made sense to cut their catch in order to speed recovery of the stock—and their own future earnings. "It was basically like putting your money in the bank and letting it compound," says Donny Waters, a Pensacola, FL-based fisherman and former president of the alliance.

They took their case to the Gulf of Mexico Fishery Management Council, to NOAA, and even to Congress, and they prevailed. With support from other fishing organizations and individuals, and a 2007 ruling by a federal judge that the current rebuilding plan violated the Magnuson-Stevens Act, a science-based rebuilding program was implemented in 2008 that has successfully ended overfishing and begun the recovery process.



Gulf fisherman Donny Waters says that limiting catch "was basically like putting your money in the bank and letting it compound."

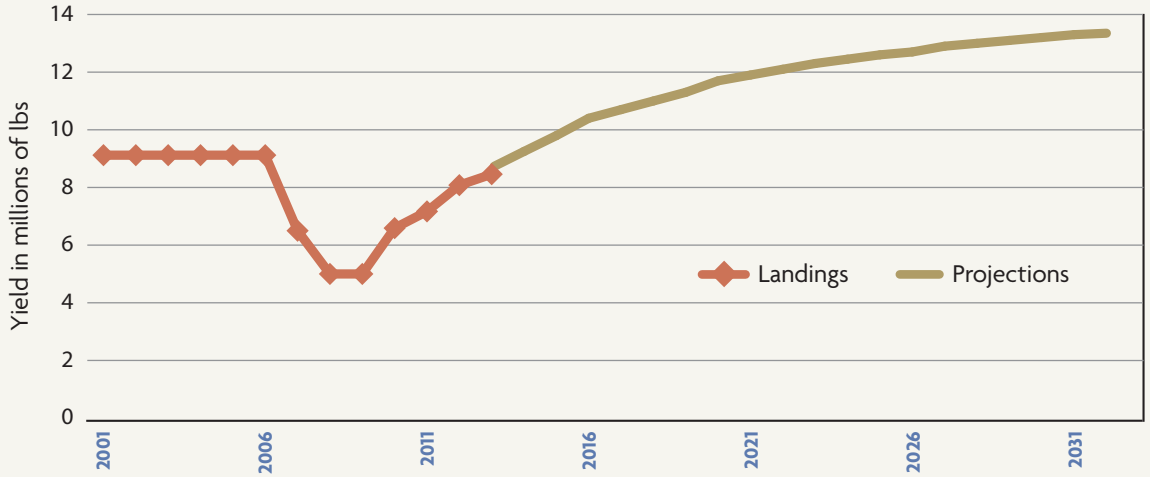
BRIAN GAUVIN, WWW.GAUVINPHOTO.COM

Donny Waters

Will the good times last? Some fishermen and scientists worry that the April 2010 BP Deepwater Horizon oil spill may have wiped out young snappers that constitute the fishery's future. "We've got three strong year classes keeping us going, but we're not seeing the juveniles to back them up," says Waters. Does the spill mean trouble for the stock's future?

Time will tell. Young fish that hatched in 2010 should mature enough to start showing up in the catch by 2013, possibly sooner, and future stock assessments should shed more light. Meanwhile, banking fish is already paying dividends for fishermen. Waters says the strategy might come in handy again if measures are needed to ensure that future generations of fish keep coming after the spill.

Benefits of rebuilding: Increase in red snapper landings



REBUILDING OUR NATION'S FISHERIES

Over the past decade, the United States made unprecedented progress in restoring depleted fish species to healthy levels. During this time, 32 stocks have been rebuilt, including a record six in 2011.[21] The reason? Commitment and contributions by fishery stakeholders, managers, and scientists, combined with provisions of the Magnuson-Stevens Act requiring that overfished populations be rebuilt within a specific time frame. (See box.)

This progress is great news for fishing communities, seafood businesses and consumers, recreational fishermen and associated businesses, and the public at large. NOAA Fisheries estimates that the payoff from rebuilding all overfished U.S. populations will be an additional $31 billion in sales nationwide and more than a million jobs.

"With annual catch limits in place this year for all domestic fish populations and the continued commitment of fishermen to rebuild the stocks they rely on, we're making even greater progress in ending overfishing and rebuilding stocks around the nation."

—NOAA news release, 2011 Status of the Stocks Report



Summer flounder was declared rebuilt in 2010.

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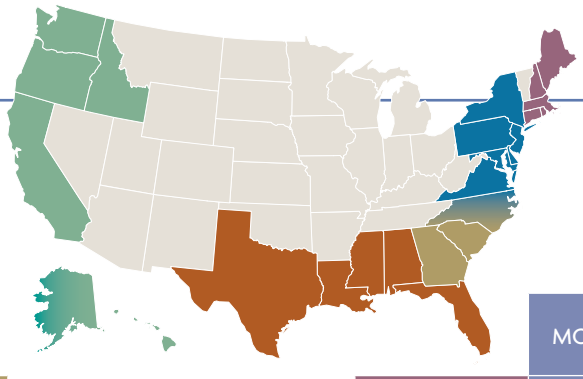
It's not a fluke: Summer flounder on the rebound

Summer flounder is second only to striped bass in popularity with mid-Atlantic anglers and ranks in the top 10 among commercial and recreational species in pounds and numbers of fish landed in the Atlantic. Yet summer flounder, also known as fluke, was subject to overfishing for years. Measures to rebuild were thwarted by the

Rebuilt Fish Stocks *as of Dec. 31, 2012*

Key: Fishery Councils

- North Pacific
- Pacific
- Gulf of Mexico
- South Atlantic/ Gulf of Mexico
- Highly Migratory Species
- New England
- New England/ Mid-Atlantic
- Mid-Atlantic



2001	2002	2003	2004	2005*	2007	2008	2009
SEA SCALLOP	SILVER HAKE**	WINTER FLOUNDER	PACIFIC WHITING	LINGCOD	SOUTHERN TANNER CRAB†	KING MACKEREL	BLUE KING CRAB
		BLACKTIP SHARK			RED GROUPER	BLUEFISH	SCUP
		YELLOWTAIL SNAPPER			SILVER HAKE***	MONKFISH***	BLACK SEA BASS
						MONKFISH**	SWORDFISH

*No data for 2006 **Gulf of Maine/Northern George's Bank ***Southern George's Bank/Mid-Atlantic †Bering Sea ††Washington Coast: Queets

triple whammy of failure to heed scientific advice, quotas set too high, and lack of reporting or other accountability.

After a 1999 lawsuit successfully challenged the quotas, fishery managers finally took steps to successfully rebuild the species. In 2010, it was declared rebuilt.[23] Economists estimate that a rebuilding plan that required catch limits and accountability measures, as called for by the recent amendments to the Magnuson-Stevens Act, would have brought an 84 percent increase in recreational landings much earlier.[24]

Still, with the following of specific steps—crafting a rebuilding plan with a reasonable probability of success, following scientific advice, setting catch limits, and monitoring the fishery—summer flounder rebounded, and managers have been able to steadily increase the quota.[25]

The rebuilding of summer flounder, bluefish, scup, and black sea bass in the mid-Atlantic region is estimated to be worth $570 million per year in additional direct economic benefits.[26]

Turning the tide on the Pacific coast

In the Pacific region, where some groundfish species were found to be so severely depleted that a federal fishery disaster was declared in 2000, six species are now rebuilt, including highly sought recreational species such as lingcod.



The Pacific lingcod population was rebuilt ahead of schedule. JIM LYLE

Designated overfished in 1999, Pacific lingcod were placed under a science-based, 10-year rebuilding plan. Fishery managers were able to rebuild the population ahead of schedule—by 2005—through a combination of science-based limits, bycatch minimization measures, area-based protections, and enhanced monitoring and accountability measures that halted fishing when limits were reached.

The entire Pacific groundfish complex is benefiting from the combination of limits and protections, and the health of other overfished populations continues to improve. Managers are beginning to increase lingcod fishing opportunities for recreational anglers in California, Oregon, and Washington.

	HADDOCK**	PINK SHRIMP
	SUMMER FLOUNDER	YELLOWTAIL FLOUNDER
	COHO SALMON††	WINDOWPANE
POLLOCK	WIDOW ROCKFISH	ACADIAN REDFISH
HADDOCK***	CHINOOK SALMON	COHO SALMON†††
SPINY DOGFISH	SNOW CRAB	SOUTHERN TANNER CRAB†
2010	2011	2012

†††*Washington Coast: Western Strait of Juan de Fuca*

NOAA

Elements of successful rebuilding programs

1. Well-defined objectives.
2. Finite timelines.
3. Established in an open and transparent process.
4. Credible, consistent, and transparent scientific monitoring of progress.
5. Simple and easily understood metrics of status and success.
6. Predefined rules for triggering corrective management action.
7. Substantial, measurable reductions in fishing mortality at the onset of the plan.[22]

BLUEFISH/JASON ARNOLD

V. Innovators find ways to make the system work



Boats are anchored in the harbor in Ketchikan, Alaska. The 49th state was the location of an early and successful fishery rebuilding program.

JAY SLUPESKY

In creating the framework of eight regional councils, the drafters of the Magnuson-Stevens Act anticipated that they would need the experience, ingenuity, and savvy of the men and women who work on the water. By bringing regional know-how and specifics to a national system of rebuilding, the councils have found myriad ways to end overfishing, recover overfished stocks, and enable people to keep fishing.

The rebuilding requirements give councils flexibility in designing plans for overfished populations. Regional bodies used that flexibility to craft plans for more than 50 commercially and recreationally important species using rebuilding timetables ranging from four to 35 years, and some even to 100 years. In fact, half the current rebuilding plans for overfished populations exceed the statutory target period of 10 years, because the law allows managers to take into account the biology of the fish, environmental conditions, and international management agreements. In those cases, the timeline for rebuilding can be extended.

As U.S. fishermen face the transition from overfishing to sustainability, many have found ways to stay profitable in the short term while they work with the councils to chart a course for long-term stability. Rob Seitz and Glen Libby are two of those innovators.



Rob Seitz, who operates a trawler on the West Coast, has found ways to adapt to fishing restrictions, such as fishing at night to avoid bycatch.

PATRICK DIXON, WWW.PATRICKDIXON.NET

Rob Seitz

Applying ingenuity to fishing

Rob Seitz, the operator of the 58-foot trawler South Bay, uses creative fishing and marketing strategies to adapt to federal regulations implemented to end overfishing on Pacific groundfish.

In response to the significant depletion of many groundfish species, NOAA Fisheries and the Pacific Fishery Management Council have implemented rebuilding plans and catch limits for overfished stocks. In the groundfish trawl fishery, the council adopted a catch-share program—one of several ways to dedicate a fixed share of the allowable catch to individuals, cooperatives, or communities for their exclusive use.

Among other purposes, the West Coast groundfish program was implemented to reduce discards and improve economic returns from the fishery.[27] NOAA Fisheries issues individual fishing quotas that may be bought and sold on the open market. To end overfishing, including bycatch of overfished species, the agency and the Pacific Fishery Management Council also dictate fishing areas where various species may or may not be caught.

One tactic that Seitz employs to deal with these restrictions is fishing at night. Petrale sole, a flatfish that spends its life on the ocean floor, lives in areas where overfished canary rockfish also swim. At night, the rockfish rise high enough off the bottom to allow the South Bay to drag for petrale without catching the rockfish.

Fishermen are also developing alternative methods, such as excluders: devices placed in the throat of a trawl net that allow a flat-shaped fish to enter but direct the ball-shaped rockfish to a hole in the top, allowing it to swim free. Innovators are also developing gear modifications such as the use of pots instead of nets to catch lingcod, which is often found with overfished cowcod. "A lingcod will go into a pot, while a cowcod won't," Seitz says.

A NOAA Fisheries observer accompanies the South Bay on every trip to record the poundage of each species caught. If too many pounds of an overfished species are caught, a boat can be ordered to stop fishing. Even so, Seitz likes having an observer onboard at all times.

"Draggers have a bad reputation for over-harvesting and grabbing everything that's down there," he says. "With an observer onboard, I can prove that's not the case."

Seitz is part of a West Coast drag fleet that uses "risk pools," which help the fishermen cope with accidental overages. Not unlike the concept of a sick-leave bank, each fisherman donates some of his quota to the marketing association's pool. If a fisherman accidentally exceeds his quota and is shut down, he can then ask to use or buy the quota he needs from the risk pool so he can keep fishing. Risk pools also advise members where to fish, helping the fleet avoid areas where overfished species are present.

Selling locally to niche markets is another strategy Seitz employs to establish more solid financial footing. He markets directly to restaurants and is exploring relationships with area universities to create a program of community-supported fishing. Modeled after local agriculture cooperatives, which arrange for the delivery of seasonal fruits and vegetables to subscribers, community-supported fishing contributes fresh seafood to area markets while providing a better price for the fishermen. In addition to helping the fishermen financially, the program connects local communities to the fisheries and fishermen who feed them.

"Draggers have a bad reputation for over-harvesting and grabbing everything that's down there. With an observer onboard, I can prove that's not the case."

— Rob Seitz

Seitz is just one of many fishermen using innovative methods to adapt to policies designed to sustain U.S. fisheries. His ability to prosper within the constraints of the Magnuson-Stevens Act shows how individuals can work within the regulations to allow resources to be managed effectively and responsibly. As he says, "It's better to live in the solution than to be a part of the problem."



Use of selective fishing methods can help protect cowcod, which are overfished. NOAA



Glen Libby, who fishes out of Port Clyde, took this approach: "It was either make this work or quit, and I'm too stubborn to quit."

RAVIYA ISMAIL/EARTHJUSTICE

Glen Libby

Port Clyde: The little port that could—and still can

Decades after the collapse of New England's top fish populations, including cod and flounder, only a few communities continue the region's rich fishing tradition. The tiny enclave of Port Clyde in Maine is one of them, and Glen Libby is a reason. "It was either make this work or quit, and I'm too stubborn to quit," he says. Libby has been fishing for groundfish and shrimp out of Port Clyde for almost 40 years. His father fished there before him, and his brother Gary and son Justin have followed the family tradition.

Libby's humility aside, credit Port Clyde's survival to more than stubbornness. Libby and his peers have learned to deal with hardship, creating opportunities amid a legacy of beaten-down fish stocks.

A former member of the New England Fishery Management Council, Libby helped found the Maine Coast Fishermen's Association, which has rallied the tenacious few remaining draggers in Port Clyde and other small ports to find ways of adapting. Inventive and determined, fishermen in this port are using the tools afforded them under the Magnuson-Stevens Act to earn a sustainable living, including:

- Trimming operating costs with fuel-saving practices, and honing their fishing methods to target available fish stocks while avoiding depleted ones.
- Taking advantage of less-hectic fishing schedules under New England's recently developed "sectors" system.
- Embracing risk-management techniques from other industries by creating a bycatch risk pool. (A net full of fish the fishermen have no quota to catch, known as a "catastrophic tow," could bring hefty costs or even shut them down.)
- Cultivating customers who pay more for the fish. One early marketing innovation was allowing consumers to buy seafood by subscription via community-supported

fisheries. The idea has caught on: More than 80 similar initiatives have sprouted in fishing ports around the country.

- Selectively capturing and marketing the long-forgotten Acadian redfish, which has finally rebounded to healthy population levels, decades after the stock collapsed under industrial fishing pressure.

These and other innovations became necessary in 2008, when the cost of diesel fuel reached record highs, climbing above $4 per gallon. "I was hammered by high fuel and low fish prices and ended up having to sell my federal fisheries permit to help the family business get out of debt," says Libby. He and other vessel owners teamed up with researchers to test whether larger-mesh and lighter netting would reduce drag and save fuel. It did: Field trials showed fuel savings of 20 percent to 30 percent. Libby says his son Justin's fuel records indicate a reduction of 30 percent, which saves about $100 a day. In addition, the larger mesh reduces bycatch, especially of juvenile fish.

Another improvement was the switch from fishing under "days-at-sea" rules—a cap on the number of days that fishermen could fish—to community-based sector management, Libby reports. "Under the old rules, the clock was always ticking," he says. "You had to get to the [fishing] grounds as quickly as possible and catch as many fish as fast as you could, which meant heavier gear, more discards, and more fuel burned. Now fishermen can run the engines easier, use flow meters, and save fuel. One big difference from days at sea is that now we have time to be innovative, to experiment, to try things that will help us survive. We're taking fewer fish, but they're higher quality, and we are making more money with less effort and less effect on the environment."



The community of Port Clyde continues a long tradition of fishing in Maine.

MIDCOAST CHAMBER COUNCIL, WWW.MAINESMIDCOAST.COM

To ease the pinch of bycatch limits, the association is establishing a risk pool. Although such pools are new to New England, they have proved successful in the West Coast groundfishery. "Without the risk pool, one bad tow or catching only one of a critical species could mean the fisherman would have to buy more expensive quota or tie up for the rest of the season," says Ben Martens, executive director of the Maine Coast Fishermen's Association and manager of the sector.

"We're taking fewer fish, but they're higher quality, and we are making more money with less effort and less effect on the environment."

— Glen Libby

To make the most of what it can catch, Port Clyde's fleet has ventured into new fishing methods and marketing initiatives. "They're building pieces of their business around methods and target fish they never considered before, like using jigging machines for redfish or catching and selling sculpin, dogfish, or skates," says Martens. "We're turning what used to be waste into a resource."

Some association members have a processing and marketing operation, Port Clyde Fresh Catch, and it is prospering. Libby, who oversees it, says: "We're running about 30 percent above where we were last year at this time. We're buying all sorts of species, including squid and rock, snow, spider, and Jonah crab; we sell cracked claws. We're able to take in product that had no market or value a couple of years ago. Now local chefs love experimenting with underused species."

Libby adds: "Local fishermen gain by being able to sell their catch in Port Clyde. By not going to auction in Portland, they save on trucking, auction fees, shrinkage allowance, and brokers. That amounts to about 25 cents not deducted from the $1.50 a pound they get for hake, for example, and the savings are higher with higher-priced fish."

VI. Limits + technology + cooperative research + area protections = increased revenue



A fish is weighed as part of the California cooperative fisheries research program. NOAA

The Northeast scallop fishery is an example of how a severely overfished population was rebuilt through tough limits and area protections, monitored with innovative technology, and assessed by collaboration between scientists and fishermen, all adding up to a major return on investment.

Sea scallops were severely overfished in the early 1990s. Intense regulation of the fishery began in 1994 with entry limitations, effort restrictions, crew size reductions, and dredge ring and mesh size modifications to allow small scallops to escape and reduce bycatch. A schedule tied to the days-at-sea provision was aimed at reducing fishing mortality. At the same time, four areas on Georges Bank were closed to protect depleted groundfish, further reducing areas available to scallop fishing. Landings continued to decline, and a 1996 assessment again indicated that sea scallops were overfished. Passage of the Sustainable Fisheries Act in 1996 imposed further restrictions to reduce mortality and rebuild the stock in 10 years. Additional areas were closed, and days were cut further.

Meanwhile, in the groundfish closure areas, the untouched scallops prospered. In the first 20 months of the closures, sea scallop biomass tripled within the areas, which became the object of curiosity and scrutiny. In the late 1990s, fishermen and NOAA researchers collaborated to design surveys of the closed areas using video technology developed by the industry and the University of Massachusetts, Dartmouth. Through careful regulation and collaboration with scallop fishermen, the stock was rebuilt in 2001. It is now the top-valued fishery in the United States, producing 57 million pounds valued at more than $449 million in 2010. This is a fivefold increase in landings from the early 1990s and an even greater increase in revenue.

BYCATCH STANDARD PROVES MAGNET FOR INGENUITY

Development of risk pools for reducing bycatch is a major innovation in fishery management, providing an opportunity for people to make money in difficult circumstances. Rob Seitz and Glen Libby are part of a long line of innovators who developed methods to make fishing profitable within the constraints necessary to ensure long-term sustainability.

One example of such ingenuity is gear modification. In the 1970s in the Gulf of Mexico, fishermen developed gear to remove jellyfish that clogged their nets and eject protected marine turtles, the catch of which could have shut down their fishery. That know-how led to devices such as the Jones-Davis bycatch reduction device, the top-performing gear for reducing finfish bycatch in the shrimp fishery.

Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

—National Standard 9 of the Magnuson-Stevens Act

Bycatch, which is specified in the national standards has been a concern to fishermen and managers in several areas: as waste or discards; as an allocation issue between fishing sectors, such as catch of valuable salmon, halibut, or crab in groundfish fisheries; or as an overfishing issue that hinders rebuilding of species. In the past 15 years, the Magnuson-Stevens Act has driven fisheries to a higher level of performance while pushing innovation in science and management. Despite protests that implementation of tough requirements would ruin the fishing business, new rules instead have promoted innovation, expanded markets, and built technologies that the rest of the world can use. Separators allow catching cod without taking halibut, and trawling for shrimp while minimizing the taking of juvenile snapper. Other devices deter turtles, birds, and mammals from bait and catch. Video cameras are now used for catch monitoring, sampling, and stock assessment. Cutting-edge technologies employ remotely operated underwater vehicles, autonomous underwater vehicles, and other submersibles, all of which are revolutionizing our knowledge of the ocean and improving stock assessments.



The top-performing Jones-Davis bycatch reduction device was developed by a shrimp fisherman in Freeport, TX.

CHRIS DORSETT

VII. World-class science: The foundation of sustainable fisheries



Remotely operated vehicles are one example of the technology that has revolutionized knowledge of the ocean and improved stock assessments.

NOAA

By any measure, the science infrastructure supporting U.S. fisheries is world-class. The scientists, ecologists, and fish biologists who perform stock assessments are widely published and in demand by regional and international workshops and conferences. NOAA Fisheries is considered a world leader in the development of fisheries stock assessment models[28]—one reason for U.S. leadership in efforts to prevent overfishing and rebuild overfished stocks.[29]

In a review of the management effectiveness of the world's marine fisheries, a group of scientists from around the globe assessed the U.S. system as having a good probability of sustainability based on more than 1,000 interviews with scientists and managers.[30]

The United States is exporting not only fish, but fisheries science. And if imitation is the sincerest form of flattery, then fishery managers should be flattered at the adoption of American management models in fisheries all over the world.[31] NOAA scientists serve on international fishery panels and are singled out for honors by these bodies.[32] In addition, their data are used by international and regional management organizations and other nations.[33] American scientists and managers also have been successful in persuading such bodies to adopt the science-based approaches developed here to protect shared fishery resources, such as tunas and sharks, that range far beyond our borders.[34]



Science-based catch limits help ensure the long-term sustainability of recreational fishing so that future generations of anglers can enjoy this popular pastime.

DAVE MOREL

Accurate, reliable science is critical to successful fishery management[35] and raises confidence that managers are preventing overfishing and achieving optimum yield, a key goal of the Magnuson-Stevens Act.[36] Despite challenges to the research that informs rules for fishing, repeated investigative reports to Congress have found that the science meets the law's requirements for "best scientific information available" and is suitable for decision-making.[37]

"I want to pay tribute to the U.S. for their great achievements in managing fisheries in accordance with the best available science and ending overfishing, based on the Magnuson-Stevens Act. The U.S. has shown us the way on sustainability."

—Maria Damanaki,
European Union fisheries commissioner

"Best available" science involves more than stock assessments, however. It includes biology, at-sea observations, decades of landings and catch information, rapid assessment methods and models, decision tools, and other information that scientists use to understand the ocean, the fish, and the effects of our actions.

The regional fishery management councils rely heavily on the six regional NOAA Fisheries science centers, in conjunction with the interstate commissions and state fish and wildlife agencies, to collect data. The scientific bodies provide the information for management decision-making, particularly with respect to overfishing, the rebuilding of overfished stocks, and the catch-setting process.

The NOAA Fisheries science centers focus on stock assessments and other tools that help managers determine the effects of fishing on fished populations.[38] Established procedures for regional stock assessment and peer review evaluate the status of stocks and catch specifications. External reviews through the Center for Independent Experts provide additional impartial evaluation of fishery stock assessments to ensure the reliability and credibility of the agency's scientific information.[39]

When Congress reauthorized the Magnuson-Stevens Act in 2006, it strengthened the role of science in the fishery management councils' decision-making.[40] The law now requires the councils to maintain Scientific and Statistical Committees to make recommendations for acceptable catch and other management measures.[41] Importantly, these reforms state that the councils' catch limits may not exceed the recommendations of these committees.[42]

In addition, each Scientific and Statistical Committee must provide its council with a wide range of other scientific advice on such topics as overfishing, bycatch, habitat status, the social and economic impacts of management measures, and the sustainability of fishing practices.[43] By requiring councils to maintain science committees and to set catch limits based on their recommendations, these reforms help address past problems caused when councils disregarded or downplayed scientific advice.

Fisheries science is intrinsically uncertain, and it can and should be continuously improved. Furthermore, it is impossible to assess 537 managed populations every year. This does not mean that councils cannot make choices or that managers cannot manage, however. The Scientific and Statistical Committees have worked with federal, state, and university scientists to examine and apply techniques developed around the world for managing fisheries without formal assessments, using life history information, catch statistics, and survey index data to set overfishing levels.[44] These committees are working to apply, test, and improve these techniques for fisheries in the Gulf of Mexico and in the Pacific, North Pacific, and South Atlantic oceans. With these tools, scientists provide the councils with information that guides their choices on setting annual management measures.

As George Geiger, the recreational fisherman and former South Atlantic council chair profiled above, explained to Congress in his 2011 testimony: "Our stock assessment process



LEDA DUNMIRE

The South Atlantic Fishery Management Council is one of eight regional organizations overseeing the nation's fisheries under the Magnuson-Stevens Act.

Good science does not equal certainty. It means working with available information, applying methods and decision-making principles to what we do know, and subjecting the information and the process to rigorous, arm's-length scrutiny.

is a collaborative one that includes fishermen, stock assessment biologists, council members, and staff and provides extensive opportunity for public input at each step in the process. Driven by the annual catch limit requirements, we have figured out rational scientific ways to set catch limits for stocks when full stock assessments are not available."

Going forward, better communication of science is needed to reduce misunderstandings between NOAA Fisheries and the industry that have eroded fishermen's trust in agency science.[45] Increased federal investment in the information infrastructure used to manage fisheries sustainably is essential for informed decision-making and stewardship of resources, and for realizing the full economic potential of our nation's fisheries.

In recent years, strong bipartisan support for increases in federal funding enabled NOAA Fisheries to maintain vital survey work, increase monitoring in high-priority fisheries, hire scientists for all regions, and build assessment capabilities in regions with highest need. Although some progress has been made in improving and expanding the capacities of these strategic program areas, substantial needs remain unmet for these sources of information. Additional investments will be necessary over the next decade to keep pace with demand for information and scientific advice for setting catch limits and making other management decisions.

The information provided by these programs improves our science, helps mitigate uncertainty in fishery decision-making, and is vital to the objectives of the Magnuson-Stevens Act. A sustained commitment of federal funding, coupled with additional sources of non-federal funding for these core activities, is essential.

Through the benefits of healthy marine ecosystems, fresh seafood, recreational opportunities, and associated economic and social advantages, the nation gets a significant return on its investment.

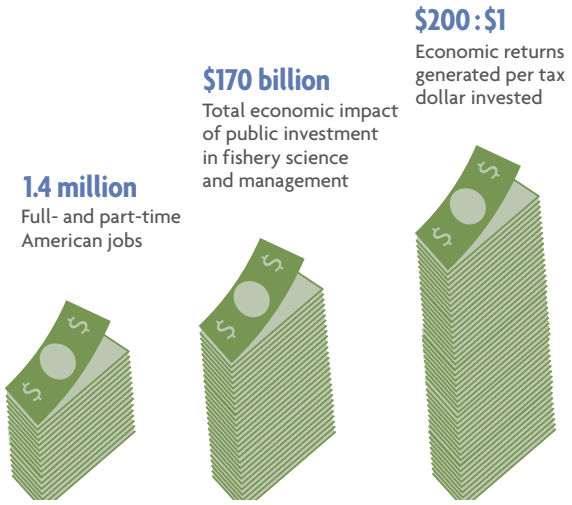
RETURN ON INVESTMENT

Sustainability gives U.S. fishermen an edge in global markets and provides coastal communities with world-class sportfishing

American fishermen enjoy a competitive edge in world markets because of strong and sustainable management policies. This advantage is reflected not only in jobs and economic returns at home but also in export gains, especially when overseas competitors stumble as a result of sustainability problems. On the recreational side, sound policies provide opportunities that enhance quality of life, generate business for coastal communities, and preserve the nation's fishing heritage.

U.S. ocean fish are a job-creating economic engine that is growing in value. The most recent federal economic data find that commercial and recreational fisheries provide 1.4 million American jobs and contribute $72 billion to the gross domestic product.[46] This value is higher than the total gross domestic product of 143 of the world's countries.[47] Even better news is that U.S. fishery resources are becoming increasingly valuable as smart investments in sustainability are paying big dividends.

What we gain from good management



NOAA 2012, 2011

The future is bright for America's commercial fishing industry. The world population is growing and demanding more seafood, but the global supply is threatened by rampant overfishing, and 32 percent of the world's marine fish are overexploited or depleted.[48] Even if other nations replicate our best practices and manage their fisheries more effectively, the market for sustainable seafood is growing.

U.S. fishermen are capitalizing on the opportunity. The combination of legal and regulatory requirements under the Magnuson-Stevens Act and smart investments in sustainability are enabling the U.S. commercial fishing industry to catch more fish and get more value from the fish it sells. In 2010, commercial fishermen from coast to coast landed a total of 10.1 billion pounds of seafood, a 17-year high valued at $5.3 billion.[49] Since 2001, 32 U.S. ocean fish stocks have been rebuilt to healthy levels, including New England sea scallops, mid-Atlantic bluefish, Pacific lingcod, and summer flounder, providing a much-needed boost of jobs and revenue for coastal towns. These gains for the fishing industry touch many lives, from the families of boat captains and crews, to processors, seafood markets, and restaurants, and to a variety of small businesses that depend on purchases of fuel, ice, nets, and bait.

U.S. fish producers are capturing new domestic markets as major retailers embrace purchasing policies that require them to source from fisheries with strong sustainability standards. At the same time, exports are rising.[50] American fishermen are even making inroads in China, where a growing middle class is rapidly creating one of the world's largest consumer seafood markets. "U.S. aquatic exports to China increased 58 percent to $930 million in the first ten months of 2011" after a 24 percent gain in 2010, according to year-end reports on trade in fisheries products from the U.S. Department of Agriculture. A major component of this increase was salmon, a largely successful fishery because of rigorous catch limits and in-season regulations in Alaska.

The gains are equally impressive in recreational fishing. In 2010, 10 million anglers made more than 69 million recreational fishing trips in America's oceans, purchasing millions of dollars' worth of gear, bait, and other supplies.[51] This trip count rivals the total attendance for Major League Baseball, which was just over 73 million that year.[52] The most recent federal economic data found that these angling trips and expenditures totaled $50 billion, generating an additional $23 billion in value-added economic activity.[53]

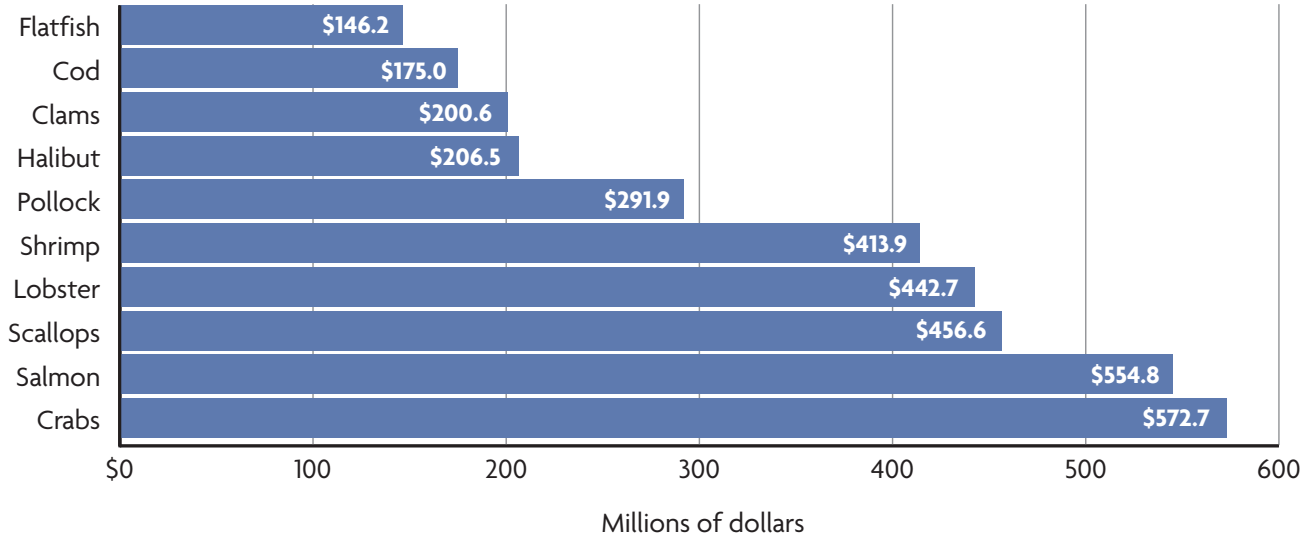
Recreational fishing creates economic ripples that generate income and jobs in businesses such as tackle and accessories production; boat manufacturing, sales and service; and travel and hospitality. The rebuilding of species important to sportfishermen such as salmon, swordfish, rockfishes, bluefish, snappers, and summer flounder adds value to the estimated earnings in the commercial sector. As a result of good management, many of these valuable fisheries have recovered from disaster. Today, they support high-profile recreational destinations that draw tourists from around the country and the world.

Ocean fish also have great value beyond fishing and seafood. Fish populations are an integral part of the larger marine system, which includes corals, seabirds, marine mammals, and sea turtles—important living resources that provide ecological benefits as well as economic value for activities such as recreation and tourism. U.S. scuba divers take an estimated 1.7 million dive vacations each year, spending more than $4.1 billion in dive-related vacations annually.[54] According to an industry study, recreational scuba diving and snorkeling contribute about $11 billion to the U.S. gross domestic product and create 26,000 full-time tourism-related jobs.[55] These industries benefit from our world-class fishery management system.

NOAA Fisheries estimates that the return on investment for rebuilding all overfished U.S. populations will be an additional $31 billion in sales nationwide and more than a million jobs.[56]

The future is full of promise if we remain vigilant in pursuing science-based management. U.S. fish populations are recovering, and the global seafood market is growing. America's investment in top-notch fishery science and our commitment to a responsible management system that translates good science into enforceable conservation limits add billions of dollars to the economy, support hundreds of thousands of jobs, and contribute to the well-being of communities and the people who depend on a healthy coastal environment for their livelihood.

Top 10 U.S. fisheries by value, 2010



Al Burch

Paying attention to science delivers long-term payoff



Al Burch, who trawls for Pacific ocean perch, welcomes the onboard observer program. "It kept us in business," he said.

FACES OF THE KODIAK KING CRAB FISHERY COLLECTION, KODIAK MARITIME MUSEUM

Nearly 50 years ago, Al Burch was crabbing in the Gulf of Alaska when he and his brother looked up to see a gigantic Russian factory ship looming near. "It was stacked high with something red on deck, and they had crab pots hanging over the side," Burch recalls. "We started chasing them. Even going full speed, we couldn't make much headway on them. We got close to them, though, and it was Pacific ocean perch that they had on board."

Burch was witnessing one of the Soviet Union's most harmful exports: an armada of freezer trawlers raiding distant seas. The long-lived, slow-growing ocean perch, sometimes called red rockfish, were no match for this unprecedented industrial fishing pressure. A coordinated fleet of more than 100 Soviet freezer trawlers systematically hauled away most of the near-virgin stocks of this species. Their job done, the Russians steamed away. Then Japanese factory trawlers took what was left.

Burch joined the fight to drive out the foreign fleets, and after passage of the Magnuson-Stevens Act, he spent decades helping to nurse the depleted perch resource back to health. The fishery, which was fully domestic beginning in 1991, came under a rebuilding plan in 1994 to repair the damage from foreign overfishing. As a leader of Kodiak's trawl fleet and a long-serving member of the North Pacific Fishery Management Council's groundfish advisory panel, Burch supported—and endured—a long string of bans, bycatch rules to protect perch, area closures, and, eventually, tight catch limits designed to protect the population once the stock grew large enough to support some landings.

The North Pacific council used a tiered system for setting limits based on how much information scientists had on hand: the less information, the more stringent the limits. Since red rockfish came under the council's rebuilding plan, the spawning stock biomass of this deep-dwelling species has tripled.[57]

The catch limits were used in combination with monitoring, area closures, and tough bycatch limits on other rockfish species associated with Pacific ocean perch. Research continues today to improve estimates of the population, to better understand its structure, and to enhance information on how habitat and predation affect juvenile perch.[58]

Today, Burch's two boats and other trawlers from Kodiak are fishing again on the rebuilt Pacific ocean perch. Allowable catches have steadily increased, reaching nearly 41.9 million pounds in 2012. A novel cooperative system permitted under the Magnuson-Stevens Act allowed the fishermen to extend their season from three weeks to more than six months, and trim bycatch rates that constrained their access to available rockfish quota. The fleet's earnings from the species doubled by 2007.

By sharing data to avoid bycatch "hot spots," the fleet targets the available perch while steering clear of areas found to be full of off-limits species such as salmon. "The hot-spot authority works," says Burch. "We're using that in the Pacific ocean perch fisheries a lot."

One key to the Kodiak trawlers' success is their embrace of observer coverage. Data from independent scientific observers allow fishermen to manage catches precisely—and to fend off unfounded criticism. "It doesn't sound like the East Coast is too happy with it, but, boy, we sure are here," Burch says. "It kept us in business."

Beginning more than two decades ago, Burch's fleet didn't just accept observers onboard the boats; it lobbied to get them. The aim? To disprove allegations that the fleet was raking up large quantities of bycatch and destroying vulnerable corals. Once independent observer data were available, the rhetoric cooled, he says. "They had to prove their statements. They became a lot more careful."

VIII. Future fishery frontiers



Fishermen in Alaska's Cook Inlet head from the beach at Cohoe to retrieve salmon in set nets, which are anchored within 1½ miles of shore.

PATRICK DIXON, WWW.PATRICKDIXON.NET

Expanding our view to the ecosystem

As we increase our understanding of the ocean and its inhabitants, we are learning that it is critical to protect not only economically important populations of fish but also interrelated species and the surrounding ecosystem. Ending overfishing is just the beginning of sustainable fisheries management.[59] In 1996, the Sustainable Fisheries Act added bycatch reduction and habitat protection to the Magnuson-Stevens Act giving us a solid foundation from which we can manage fish as part of the entire system.

The importance of this broader view is that catch limits are merely one component of maintaining sustainable fisheries. Changes in water quality from upland uses, weather, or accidents such as oil spills can affect spawning adults and recently hatched juveniles. The dead zone in the Gulf of Mexico is an example of the downstream effects of agricultural practices combined with unpredictable rainfall. Coastal development can alter marshes, estuaries, and similar areas that are critical at certain life stages of marine animals.

But perhaps the greatest challenge facing fishery managers is adapting to a changing global climate. Scientists are predicting that as ocean waters warm, fish distributions will move toward the poles and to deeper waters. The size and location of populations of many species of forage fish on the West Coast, such as anchovies, sardines, and capelin, change with shifts in ocean temperatures, affecting the availability of food for larger predatory fish valued by recreational and commercial fishermen.

Fishery managers cannot control any of these events with catch limits, but they can account for them as part of an overall approach to fishery management. In order to plan and prepare for the consequences of global climate change on the ocean, we need to focus on enhancing ecosystem resilience by building on past restoration successes and habitat protections. An ecosystem-based approach to management requires consideration of commercially and recreationally important species and the effects of fishing activities on other areas. Such issues as biodiversity, food web interactions, and habitat maintenance must be addressed in order to preserve the health of the ecosystems that sustainable fisheries and marine wildlife depend on.[60]

Although ecosystem-based fishery management recognizes the shortcomings of conventional single-species management, proponents do not want to eliminate conventional single-species approaches. Instead, they want to improve existing assessment and management methods to incorporate a more ecologically realistic and inclusive view of sustainability into existing practice.[61] The benefits of such an approach accrue to fisheries and other "ecosystem services" that the marine and coastal

environment provides. These services include fuel, mineral resources, pharmaceuticals, flood control, and water cycling as well as opportunities for recreation, trade, research, and education.[62] The challenge for fisheries managers is how to apply widely accepted principles in practical management decisions.

Scientists, managers, fishermen, and members of Congress have been talking about ecosystem-based approaches to fishery management for more than two decades. Congress requested a report on the topic in 1996, and numerous tools and approaches are in place. The final report to Congress of the U.S. Commission on Ocean Policy noted that the offshore area of the country's exclusive economic zone is the largest in the world. To preserve the resources of this vast territory for the benefit of all Americans, the commission called for fishery managers to begin moving toward an ecosystem-based approach to look beyond fisheries and consider interactions with other resources and activities.[63]

A task force of scientists, for example, recently described the major impact of little fish such as herring, anchovies, menhaden, and sardines and concluded they have twice as much value left in the water to feed other fish than as target catch themselves, even though they account for more than one-third of wild marine fish caught globally.[64] How managers allow for the role of these forage fish is just one of the remaining frontiers in our understanding of ocean ecosystems.

Although work remains to rebuild depleted stocks, some fishery management councils and the scientists who advise them are asking questions about more than just setting catch limits. They are considering habitat, socioeconomics, ecological information, and other factors that go into shaping our expectations for how we achieve continuing yields from the waters off our coasts.



NOAA

Fish cluster around a coral cap at Flower Garden Banks National Marine Sanctuary off the coast of Texas.

The councils already have the authority under the Magnuson-Stevens Act to employ an ecosystem-based approach to habitats and wildlife. The law's definition of conservation and management recognizes the importance of protecting marine ecosystems and avoiding long-term adverse effects on fishery resources and the marine environment.[65]

Specific examples include the authority to reduce fishing levels to account for ecological factors,[66] and to identify and protect essential fish habitat.[67] Councils may consider ecological factors such as component species in the ecosystem, forage fish stocks, predator-prey dynamics, competitive interactions, marine mammals and birds, and threatened or endangered species.[68]

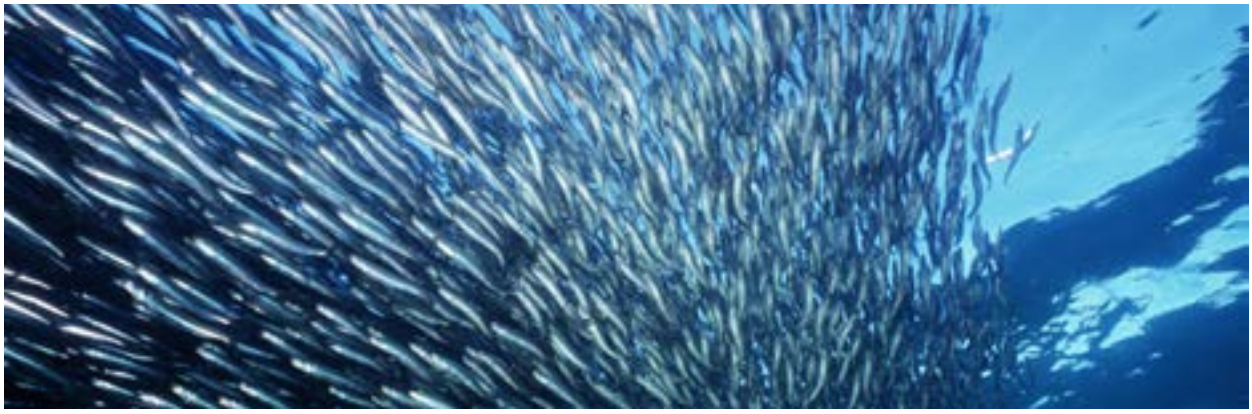
Some councils already use identification of essential fish habitat, stock assessment and fishery evaluation reports, environmental impact review, and fishery ecosystem plans. Since 1999, the Western Pacific, North Pacific, and South Atlantic councils have devised ecosystem plans, but there is little guidance from NOAA Fisheries or the law itself on how to develop these plans or how they relate to regulatory measures.[69]

Separately, however, revisions to habitat protection measures in 2006 strengthened the councils' authority to address ecosystem concerns by adding new language on habitats, authorizing them to protect deep-sea corals and restrict the use of destructive gear types within known areas of deep-sea coral habitat.[70] This action meant councils could protect vulnerable marine habitats and species in their own right as important components of the marine ecosystem, even without a determination that they were essential habitat for a fishery.[71]

These are important tools, yet councils and managers lack specific legal mandates to address the broader issues that affect fish and the environment that marine species depend on. For instance, there is no requirement to set forage fish catch limits low enough to accommodate the needs of the fish and wildlife that need them for food. Nor is there a requirement to develop fisheries ecosystem plans and ensure that management measures are consistent with those plans.

Ecosystem-based management will require broader thinking and possibly changes in law and policy. One step would be continued development of our science and understanding. Another would be the application of tools to assess the health of fish populations. These include risk analysis and expansion of current stock assessments to incorporate other key environmental factors, including predator-prey interactions. These initial actions would enable scientists, managers, and decision makers to think more broadly about choices.

ON THE HORIZON: TARGETS FOR U.S. FISHERIES MANAGEMENT



Northern anchovies, a species of forage fish, swim in a school in the Pacific Ocean off the coast of California.

MARK CONLIN/SEAPICS

As Congress begins to consider reauthorization of the Magnuson-Stevens Act, it is useful to draw lessons from the experiences of America's fishing pioneers and leaders. Those whose stories are told here show that it takes courage and sacrifice to make hard decisions and live with the responsibilities of stewardship. They also demonstrate that leadership, ingenuity, and investment can overcome obstacles and increase our understanding of the ocean system that supports our coastal communities.

These stories from U.S. waterfronts illustrate the hard-won shift from protecting American fishermen from foreign fleets to controlling fishing mortality. This policy sustains our fisheries and has restored our fleets to competitiveness in global markets because they operate under high environmental standards.

The authors of the Magnuson-Stevens Act created its original national standards as a declaration of American fishing rights. Today they are recognized worldwide as best management practices.

Within these standards, fishermen have found the flexibility to develop fisheries on more than 120 species, with dozens of types of gear in vessels ranging from skiffs to floating factories more than 300 feet long. Innovation and ingenuity developed technology not only for expanded fishing but also for conservation—U.S. know-how that has earned recognition around the world.

Our record of value, science, and innovation did not come without a price. Like anything worth doing, it resulted from tough decisions and sacrifice. But the investment is yielding significant and long-lasting benefits. As of 2012, we have systems in place to help end and prevent overfishing in all federally managed fisheries, and we are making substantial progress in rebuilding populations. A record number of depleted stocks were declared rebuilt in 2011, and overfishing continues to decline.

To weaken this world-class model now would be to ignore the innovation and sacrifice of those who built it over time. Now is the time instead to expand upon our history by making additional investments in science and innovation and by continuing to restore and sustain our valuable ocean ecosystems. When Congress reauthorizes the Magnuson-Stevens Act, it should consider amendments to:

- Minimize the habitat damage and bycatch of indiscriminate fishing.
- Ensure that adequate forage fish are in the water to feed the larger ecosystem.
- Promote ecosystem-based fisheries management.

The future holds new and daunting challenges for our fishermen and coastal communities, including changing ocean temperatures, acidification, and other stressors that will require managers to continue efforts to end overfishing, rebuild depleted populations, and adopt additional measures to restore healthy ecosystems. As we look forward to the reauthorization of the Magnuson-Stevens Act, we must strengthen it with measures that foster healthy, productive, and resilient marine ecosystems. The next generation of fishermen, anglers, and other Americans from coast to coast deserve the protection and enhancement of this legacy.

Endnotes

[1] Senator Warren G. Magnuson (D-WA) told a symposium a year after passage of the act that bears his name that although U.S. landings remained relatively static from the postwar period to 1973, overall landings from American waters during that time tripled because of foreign fishing. "Foreign vessels take nearly seventy percent of the commercial catch of United States coastal fisheries," Magnuson said. "The Fishery Conservation and Management Act of 1976: First Step Toward Improved Management of Marine Fisheries," *Washington Law Review* 52 (1977): 427.

[2] Debates on the Magnuson-Stevens Act bills (S 961 and HR 200) were defined by arguments about the effect on international relations of declaring a U.S. fishery zone. The debates also included extensive remarks about optimum yield, maximum sustainable yield, and the need to restore and conserve fish populations for the future.

[3] Ecologist P.A. Larkin, in his 1977 essay "An Epitaph for the Concept of Maximum Sustainable Yield," called the act's definition of optimum yield "a recipe for achieving heaven or hell, and what is achieved will depend on how the definition is variously interpreted." *Transactions of the American Fisheries Society* 106, no. 1 (1977): 9.

[4] In an article reviewing successes in fishery management, Beddington et al. cite the U.S. system as one that has found the right combination of rules and incentives to halt overfishing and accomplish rebuilding. J.R. Beddington et al., "Current Problems in the Management of Fisheries," *Science* 316, no. 5832 (2007): 1713-1716. See also R. Hilborn, "Reinterpreting the State of Fisheries and their Management," *Ecosystems* 10, no. 8 (2007): 1362-1369.

[5] The pollock and whiting fisheries of the Pacific produce more kinds of products and more pounds of seafood products per 100 pounds of fish caught: 37 in 2012 compared with 19.5 in 1998. Jim Gilmore, pers. comm., March 4, 2013, report on Product Recovery Mix 2012, Sea State Inc.

[6] National Oceanic and Atmospheric Administration Fisheries, "Fisheries Economics of the United States, 2009," Economics and Sociocultural Status and Trends Series, NOAA Technical Memorandum NMFS-F/SPO-118, May 2011.

[7] Ibid.

[8] Oceans '78 Conference, September 1978, Washington, DC.

[9] Magnuson-Stevens Fishery Conservation and Management Act, Public Law 94-265 (1976) as amended by Public Law 109-479 (2006), 16 U.S.C. 1801 et seq.

[10] "The main thrust of the legislation is to provide a mechanism and program of conservation and management in order to save and revitalize the valuable fishery resources adjacent to our shores. Time was running out on many vital stocks. This was clear to anyone who understood the situation." Warren G. Magnuson, "The Fishery Conservation and Management Act of 1976: First Step Toward Improved Management of Marine Fisheries," *Washington Law Review* 52 (1977): 427.

[11] Sustainable Fisheries Act, Public Law 104-297 (1996).

[12] U.S. Commission on Ocean Policy, *An Ocean Blueprint for the 21st Century*, final report (2004), and the Pew Oceans Commission, America's *Living Oceans: Charting a Course for Sea Change* (2003).

[13] Senate Report 109-229 on S 2012 (April 4, 2006), 21.

[14] Thomas. F. Ihde et al., "The increasing importance of marine recreational fishing in the US: challenges for management," *Fisheries Research* 108 (2011), 268.

[15] Senator Ted Stevens (AK), opening statement, field hearing (Boston) on reauthorization of the Magnuson-Stevens Act, Subcommittee on Oceans and Fisheries, Senate Committee on Commerce, Science and Transportation, April 10, 2000.

[16] Stock assessment report for South Atlantic black sea bass, Southeast Data, Assessment, and Review 25, Section 1, October 2011. Improvement in landings, biomass, fishing mortality, and spawning potential ratio are calculated from data in Tables 5.2a, Table 5.3, and Fig. 4.12.1.

[17] Ibid.

[18] George J. Geiger, testimony on "NOAA's Fishery Science: Is the Lack of Basic Science Costing Jobs?," Subcommittee on Fisheries, Wildlife, Oceans, and Insular Affairs, U.S. House Committee on Natural Resources, July 26, 2011, http://www.gpo.gov/fdsys/pkg/CHRG-112hhrg67648/pdf/CHRG-112hhrg67648.pdf.

[19] Final Rule to Amend National Standard Guidelines to Provide Guidance on Annual Catch Limits. 74 Federal Register 3178 (Jan. 16, 2009). NOAA Fisheries published a notice of intent to further clarify NS1 guidance May 3, 2012.

[20] S. A. Murawski, "Rebuilding Depleted Fish Stocks: The Good, the Bad, and, Mostly, the Ugly," *ICES Journal of Marine Science* 67 (2010):1830–1840.

[21] NOAA, 2011 Status of Stocks report press release, http://www.nmfs.noaa.gov/stories/2012/05/05_14_12status_of_stocks_rollout.html.

[22] S.A. Murawski, "Rebuilding Depleted Fish Stocks."

[23] Pers. comm., Mid-Atlantic Fishery Management Council, September 7, 2012.

[24] J.M. Gates, "Investing in Our Future: The Economic Case for Rebuilding Mid-Atlantic Fish Populations" (2009), published by the Pew Environment Group, Washington, DC, http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/final%20PEG_Rebuilding%20072209.pdf.

[25] Mid-Atlantic Fishery Management Council, Summer Flounder Monitoring Committee recommendation, 2011.

[26] J.M. Gates, "Investing in Our Future."

[27] In its report on the program's first year, NOAA Fisheries found that revenue climbed to $54 million in 2011 compared with the pre-catch share average of $38 million from 2006 to 2010. NOAA Fisheries, "Year One: West Coast Groundfish IFQ Fishery," June 2012.

[28] National Research Council, *Science and Its Role in the National Marine Fisheries Service* (National Academies Press, 2002), 3.

[29] Eric Schwaab, testimony on NOAA's fishery science, House Natural Resources Subcommittee on Fisheries, Wildlife, Oceans and Insular Affairs, July 26, 2011, http://www.commerce.gov/os/ogc/testimony/noaas-fishery-science-lack-basic-science-costing-jobs.

[30] C. Mora et al., "Management Effectiveness of the World's Marine Fisheries," *PLoS Biology* 7 (2009).

[31] Examples include reforms to the Common Fisheries Policy being considered by the European Union.

[32] NOAA, Northeast Fisheries Science Center press release, August 2009, http://www.nefsc.noaa.gov/press_release/2009/News/NR0911/index.html.

[33] NOAA, Fisheries Data Sets, http://celebrating200years.noaa.gov/datasets/fisheries/welcome.html#trawl.

[34] NOAA Fisheries, Kobe III meeting, http://www.nmfs.noaa.gov/stories/2011/07/kobeiii.html.

[35] U.S. Commission on Ocean Policy (2004), *An Ocean Blueprint for the 21st Century*, final report, 276.

[36] Eric Schwaab, testimony on NOAA's fishery science (2011).

[37] U.S. Department of Commerce, Office of Inspector General Investigative Report, letter to Sen. Snowe re: the Northeast Fisheries Science Center and the Quality of the Science Used to Determine Catch Limits for New England Commercial Fisheries, February 26, 2009.

[38] National Research Council, "Improving the Use of the 'Best Scientific Information Available' Standard in Fisheries Management," National Academies Press (2004), 27-29.

[39] Steven Murawski (2009), testimony on implementation of the Magnuson-Stevens Act before the House Natural Resources Subcommittee on Insular Affairs, Oceans, and Wildlife, Washington, DC, October 27, 2009.

[40] Senate Report 109-229 on S 2012, April 4, 2006, 6-7.

[41] U.S. Code, 16 U.S.C. §§ 1852(g)(1)(A) and (B)

[42] U.S. Code, 16 U.S.C. § 1852(h)(6).

[43] U.S. Code, 16 U.S.C. § 1852(g)(1)(B).

[44] Southwest Fisheries Science Center (2011), Assessment Methods for Data-Poor Stocks, report of review panel meeting.

[45] U.S. Department of Commerce, Office of Inspector General (2009), response to request from Senators Snowe, Collins, Kennedy, and Kerry re: "The Quality of the Science Used to Determine Catch Limits for New England Commercial Fisheries."

[46] NOAA Fisheries, Fisheries Economics of the United States, 2009, www.st.nmfs.noaa.gov/st5/publication/fisheries_economics_2009.html.

[47] Central Intelligence Agency, "The World Factbook 2012," https://www.cia.gov/library/publications/the-world-factbook/index.html

[48] United Nations Food and Agriculture Organization, "World Review of World Fisheries and Aquaculture 2010," 8, http://www.fao.org/docrep/013/i1820e/i1820e01.pdf.

[49] NOAA Fisheries, "Fisheries Economics of the United States, 2010," http://www.st.nmfs.noaa.gov/st1/fus/fus10/index.html.

[50] Ibid.

[51] Ibid.

[52] Barry M. Bloom, MLB.com, "More Than 73 Million Pack Ballparks in '10," October 4, 2010, http://mlb.mlb.com/news/article.jsp?ymd=20101004&content_id=15410876&vkey=news_mlb&c_id=mlb.

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[54] Cline Group, diving industry consumer survey, 1997, http://www.clinegroup.net/diving/report2.html.

[55] Diving Equipment and Marketing Association, "Fast Facts: Recreational Scuba Diving and Snorkeling," 2011.

[56] NOAA Status of Stocks press release, http://www.nmfs.noaa.gov/stories/2012/05/05_14_12status_of_stocks_rollout.html.

[57] Northern Pacific Fishery Management Council, Gulf of Alaska Stock Assessment and Fishery Evaluation Report (2011), Gulf of Alaska Pacific ocean perch. 826. http://www.afsc.noaa.gov/REFM/docs/2011/GOApop.pdf.

[58] Alaska Fisheries Science Center (2010), Pacific ocean perch fact sheet, http://www.afsc.noaa.gov/Education/factsheets/10_POP_fs.pdf.

[59] NOAA Fisheries, *Our Living Oceans*, "Prelude to Sustainability: Ending Overfishing in U.S. Fisheries," sixth edition, 57-66, http://spo.nmfs.noaa.gov/olo6thedition/07--Feature%20Article%201.pdf.

[60] See for example E.K. Pikitch et al., "Ecosystem-Based Fishery Management," *Science*, no. 5682 (2004): 346, http://www.sciencemag.org/content/305/5682/346.full.

[61] Robert C. Francis et al., "Ten Commandments for Ecosystem-Based Fisheries Scientists," *Fisheries* 32, no. 5 (2007): 217-233.

[62] H.M. Leslie and K.L. McLeod, "Confronting the challenges of implementing marine-ecosystem-based management," *Frontiers in Ecology and the Environment* 5 (2007): 540-548.63 U.S. Commission on Ocean Policy, 295.

[64] E. Pikitch et al., *Little Fish, Big Impact: Managing a Crucial Link in Ocean Food Webs*, (Washington, DC: Lenfest Ocean Program, 2012). http://www.lenfestocean.org/foragefishreport.

[65] Magnuson-Stevens Act, MSFCMA Sec. 3(5) (16 U.S.C. § 1802(5)).

[66] Magnuson-Stevens Act, MSFCMA, Sec. 3(28) (16 U.S.C. § 1802(28)).

[67] U.S. Code, 16 U.S.C. 1855(a)

[68] NOAA Fisheries, 50 CFR § 600.310(e)(3)(iv)(C).

[69] The North Pacific Fishery Management Council concluded that fishery ecosystem plans have no regulatory authority. See: Discussion items for developing an Aleutian Islands Fishery Ecosystem Plan, Item D-2(4), December 2005: "Barring a change in statute, a FEP cannot authorize management measures, and such authority would remain vested in the FMPs."

[70] Magnuson-Stevens Act, MSFCMA 303(b)(2)(B) (16 U.S.C. § 1853(b)(2)(B)).

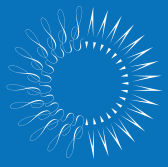
[71] See Senate Report 109-229 on S 2012 (April 4, 2006).

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