

Bringing Back the Fish:

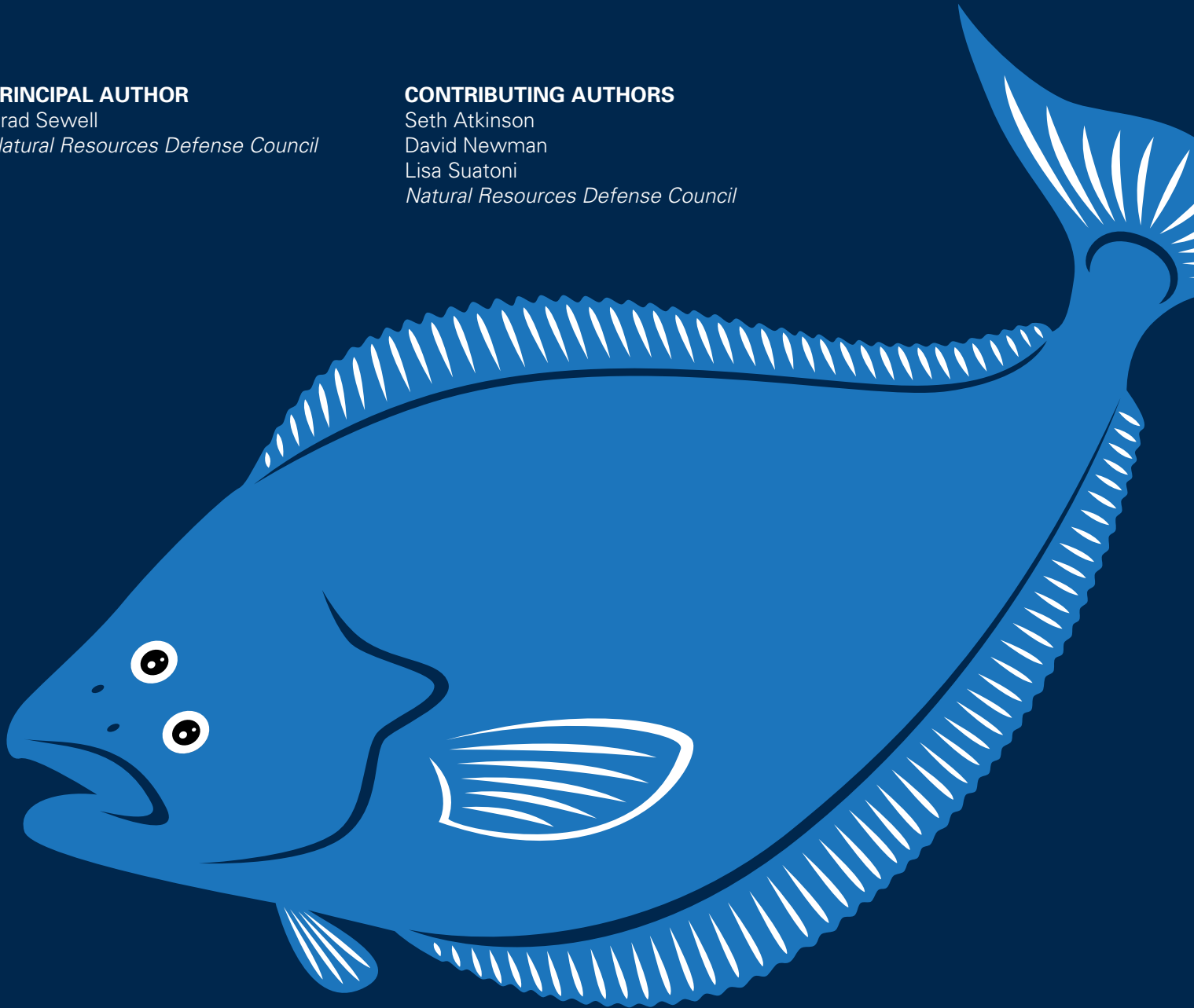
An Evaluation of U.S. Fisheries Rebuilding Under the Magnuson-Stevens Fishery Conservation and Management Act

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About NRDC

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Congress amended the Magnuson-Stevens Fishery Conservation and Management Act in 1996 to require that overfished ocean fish stocks be rebuilt in as short a time period as possible, not to exceed 10 years, with limited exceptions. As part of evaluating the success of these requirements, NRDC examined population trends of all U.S. ocean fish stocks that were subject to the requirements and for which sufficient information was available to assess rebuilding progress. Out of these 44 fish stocks, 64% can currently be considered rebuilding successes: 21 have been designated rebuilt (and have not been determined to again be approaching an overfished condition) or have exceeded their rebuilding targets, and 7 have made significant rebuilding progress, defined as achieving at least 50% of the rebuilding target and at least a 25% increase in abundance since implementation of the rebuilding plan. This success rate demonstrates that the federal law has been generally successful in rebuilding fish stocks. Our analysis also showed areas of concern, including (a) gaps in the application of the rebuilding requirements, such as with respect to stocks that are not federally managed, of “unknown” population status, or internationally managed; (b) certain regions, such as New England, the South Atlantic, and the Gulf of Mexico, with significant proportions of stocks showing a lack of rebuilding progress; and (c) continued overfishing during rebuilding plans. We also found that rebuilding fish stocks confers substantial benefits. For example,



estimated average annual 2008–2010 dockside revenues from commercial landings of the 28 U.S. fish stocks that have been rebuilt or are demonstrating significant rebuilding progress totaled almost \$585 million, which is 92% higher (54% when adjusted for inflation) than dockside revenues for these stocks at the start of rebuilding. Many of the rebuilt and rebuilding stocks also have significant economic benefits associated with recreational catch.

In the early 1990s, many of our nation's ocean fish populations were in severe decline. The most alarming and publicized example was the collapse of many of New England's iconic groundfish stocks, such as cod, haddock, and flounder.¹ Without clear legal requirements to rebuild fisheries, managers frequently put off making hard decisions and prioritized short-term yields over long-term rebuilding success. Year after year, many stocks failed to recover or even continued to decline, and fishing communities and marine ecosystems alike suffered. The collapse of New England's groundfish fisheries alone was estimated to cost the region \$350 million annually.²

In 1996, Congress addressed the fisheries crisis by amending the nation's federal fisheries law, the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, or MSA). Among other changes, the amendments—known collectively as the Sustainable Fisheries Act, or SFA—added requirements that overfished fisheries be rebuilt to healthy levels in as short a time as possible, which is not to exceed 10 years unless necessary due

Rebuilding Under the Magnuson-Stevens Act: A Technical Primer

According to the Magnuson-Stevens Act, a fish stock is overfished when it falls to a biomass or population level that jeopardizes the stock's capacity to produce maximum sustainable yield (MSY) on a continuing basis. The population level that is estimated to produce maximum sustainable yield is known as B_{msy} (in some cases, B_{msy} cannot be estimated and a proxy is used); this population level is frequently given as approximating 40% of an unfished population. In practice, the National Marine Fisheries Service and regional fishery management councils typically set an overfished "threshold" at some level below B_{msy} (often 50% of B_{msy} or its proxy), as part of designating what are called status determination criteria for the stock. When a stock assessment shows that stock abundance has fallen below the threshold, the agency designates the stock as overfished and requires the relevant regional council to develop and implement a rebuilding plan as part of a fishery management plan or plan amendment. The rebuilding plan sets a rebuilding time period that meets the requirements found in Section 304(c)(4) of the law: "as short as possible, ... not [to] exceed 10 years except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in with the United States participates dictate otherwise." The plan must also include management measures to constrain the fishing mortality level as necessary to rebuild the stock within this time period. When a population increases to above the overfished threshold but remains below the rebuilding target, it is considered not overfished but still rebuilding. By law, NMFS must review rebuilding progress no less than every two years; when the agency determines that inadequate progress has been made, the council is to be informed, and it must implement responsive management measures.

to the biology of the stock, environmental conditions, or an international agreement. Since enactment, the SFA's rebuilding requirements have been applied to more than 60 overfished stocks around the country.

Rebuilding depleted fisheries is acknowledged to be good policy by virtually everyone. Rebuilt fish populations are essential to healthy marine ecosystems. They create jobs, support coastal economies, provide stability to the fishing industry, increase recreational fishing opportunities, and bring back fresh, local seafood. Overfished stocks, by contrast, are generally less stable and at greater risk of long-term collapse, particularly when highly depleted.³

NRDC decided to undertake an examination of how effective the SFA's rebuilding requirements have been over the last decade and a half. The timing is right for such an evaluation. Congress is starting to consider the next reauthorization of the MSA and the law's rebuilding requirements are certain to be a topic of debate. A committee of the National Research Council is currently conducting an analysis of the effects of the rebuilding requirements.⁴ The last systematic examination of the implementation of the rebuilding requirements was by Rosenberg et al., published in 2006. Rosenberg et al. found that only three fisheries had been rebuilt to that point, a result labeled as "disappointing" by the authors and attributed in large part to continued overfishing.⁵ In the intervening years, however, many rebuilding programs have been completed or are nearing completion. We hope the data and analysis contained in this report will help inform the policy discussion surrounding the rebuilding of U.S. fisheries, including as part of the upcoming MSA reauthorization.

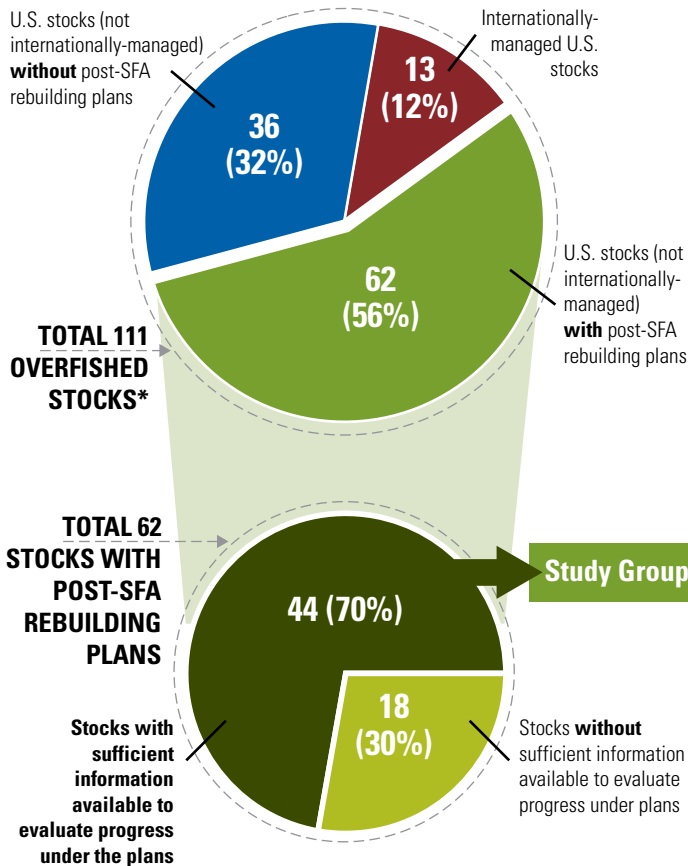
METHODOLOGY: HOW WE EVALUATED THE MSA'S REBUILDING REQUIREMENTS

Study Group Composition

Our initial step was to identify every federally managed stock that has ever been listed as "overfished" in the National Marine Fisheries Service's (NMFS) annual Status of Stocks (SOS) reports, which the agency began issuing in 1997. Out of these 111 stocks, and excluding 13 internationally managed stocks (for an explanation of why these stocks were excluded, see inset box "Tuna Troubles," p. 12), we identified 62 stocks that had been put into rebuilding plans following the SFA's enactment. As part of this step, we reviewed fishery management plans and compiled pertinent data, including implementation dates for plans and plan amendments, rebuilding time periods, and status determination criteria.

Of the 62 stocks with post-SFA rebuilding plans, we identified 44 stocks for which sufficient information was available to evaluate progress—meaning that the stock had been in a rebuilding plan for at least two years (i.e., since before 2010) and at least one stock assessment had been conducted since plan implementation. These 44 stocks are listed in Appendix A. Figure 1 depicts the process by which we composed our study group. Rebuilding-related issues and concerns with stocks excluded from the study group are discussed in Results below.

Figure 1: Composition of Study Group



* Includes any stock listed in one or more Status of Stocks (SOS) reports as "overfished," "rebuilding," or "rebuilt," although stock may not be currently listed

Evaluation Process

For each of the 44 stocks described above, we compiled and reviewed the most current publicly available population trend information. We used the same population trend information used by NMFS and the federal fishery management councils to evaluate progress of rebuilding programs. For the evaluated stocks, this information is compiled in stock "assessments," which are periodically updated and, as a general matter, are considered the "gold standard" by fishery scientists for determining the population status of a fish stock. It should still be noted that even though these stock assessments represent scientists' best understanding of the health of a stock at a point in time given the information available, they remain limited by how recently they were conducted, the quality of the data sources and uncertainties in the models used.⁶

As part of our evaluation, we examined each stock's population trend relative to its rebuilding target.⁷ We considered a stock to be rebuilt if it had been designated as rebuilt in a SOS report and had not been subsequently designated as approaching an overfished condition, or it had achieved its rebuilding target. We considered a stock to be achieving significant rebuilding progress if it had achieved at least 50% of its rebuilding target, which is often the level at which councils consider a stock to no longer be

overfished, and had increased at least 25% in abundance since the rebuilding plan's start. While continued vigilance is required to ensure such stocks stay on track with rebuilding, we wanted to be able to recognize such progress to date. We considered a stock to be showing limited rebuilding progress if it met either the 50% recovery or 25% increase in abundance criteria. We also considered a stock to have demonstrated limited rebuilding progress if it had been rebuilt but was subsequently designated as approaching an overfished condition. Finally, we considered a stock to be showing a lack of rebuilding progress if it met neither the 50% recovery nor the 25% increase in abundance criteria. (For more about what "overfished" means and what a rebuilding plan is, see inset box "Rebuilding Under the MSA: A Technical Primer," p. 4. Appendix B provides additional information about our evaluation's methodology.)

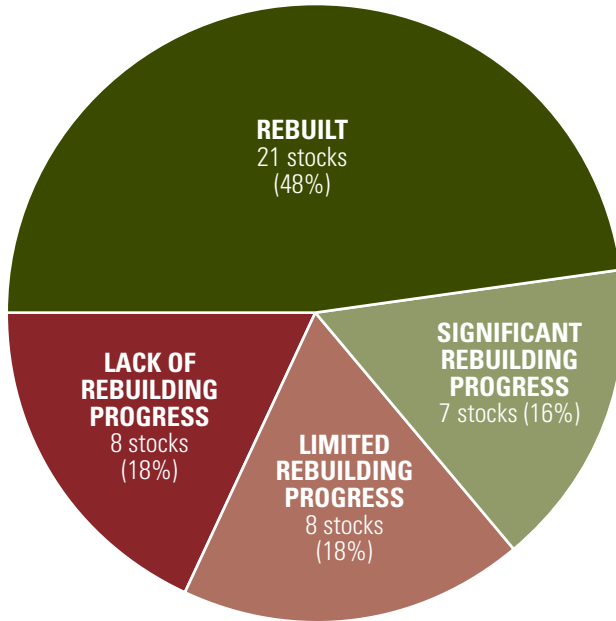
RESULTS: WHAT OUR EVALUATION OF REBUILDING SHOWED

Gaps in the Application of the Rebuilding Requirements

As an initial matter, we identified the following important gaps in the application of the MSA's rebuilding requirements:

1. Certain stocks, such as river herring, shad, menhaden, and Atlantic sturgeon along the Atlantic coast, are not currently federally managed and therefore are not subject to the MSA's rebuilding requirements, even though they are caught in significant numbers in federal waters and are recognized to be depleted. Such stocks may have rebuilding programs under the relevant states' legal authorities, but such programs do not need to meet the MSA's standards.
2. Internationally managed stocks are subject to less stringent rebuilding requirements under the MSA, even though a high proportion of such stocks are designated as overfished (for more, see inset box "Tuna Troubles").
3. Thirty-seven stocks have been designated as overfished at some point since the SFA's enactment but never received rebuilding plans. For many of these stocks, this is likely not a cause for significant concern. For example, 13 of these stocks are salmon or similar anadromous stocks, most of which are primarily or exclusively managed under the Endangered Species Act, which affords similar or greater protections; another 13 stocks had their overfished designation changed to "not overfished" or "rebuilt" prior to the development of a rebuilding plan. But the change in status could be masking depletion concerns for some. In particular, six stocks were redesignated from "overfished" status to "unknown" status, with no rebuilding plan put in place.⁸ This is troubling, as these stocks may well be significantly depleted but no rebuilding measures are being taken. Overall, more than 200 stocks (including more than 50 that NMFS considers to be major stocks) listed in the current SOS report are designated as having "unknown" or "undefined" overfished status.

Figure 2: Current Rebuilding Status of Stocks Subject to Post-SFA Rebuilding Plans. Stocks must have sufficient information available to evaluate progress under rebuilding plans.



64% of stocks are either rebuilt or exhibiting significant rebuilding progress

Significant rebuilding progress:

≥50% of rebuilding target AND ≥25% increase since plan start

Limited rebuilding progress:

≥50% of rebuilding target OR ≥25% increase since plan start

Lack of rebuilding progress:

<50% of rebuilding target AND <25% increase since plan start

National Rebuilding Trends

Of the 44 overfished stocks covered by the SFA's rebuilding requirements that we analyzed, 28 stocks, or 64%, are now rebuilt or are showing significant rebuilding progress.⁹ Twenty-one of these 28 rebuilding “success stories” are rebuilt.¹⁰ The remaining seven stocks are showing significant rebuilding progress (see Figure 2, above, and Appendix A).

The news is not all good. Of the 44 stocks, 16 are not yet showing significant rebuilding progress. Eight of the 16 stocks are showing at least limited progress. Seven of these eight have either recovered to at least 50% of the rebuilding target or increased at least 25% in abundance since the rebuilding plan's start. Of the 7, South Atlantic black sea bass is the only stock that has exceeded 50% of the rebuilding target but not increased 25% since its rebuilding plan start. Gulf of Maine haddock in New England, which was recently designated as again approaching an overfished condition after just being designated as rebuilt in 2011, was evaluated as showing limited rebuilding progress. The rebuilding of the remaining 8 out of the 16 stocks has been more troubled, as they have failed either to recover to the 50%-of-target threshold or to increase at least 25% since the start of their rebuilding plans (see Figure 2 and Appendix A).

Although explanations for rebuilding success, or lack thereof, are generally stock-specific and involve multiple factors, continued overfishing during the rebuilding period likely played a role in the disappointing recovery of some of the 16 stocks in our study group evaluated as not yet showing significant rebuilding progress (i.e., only limited

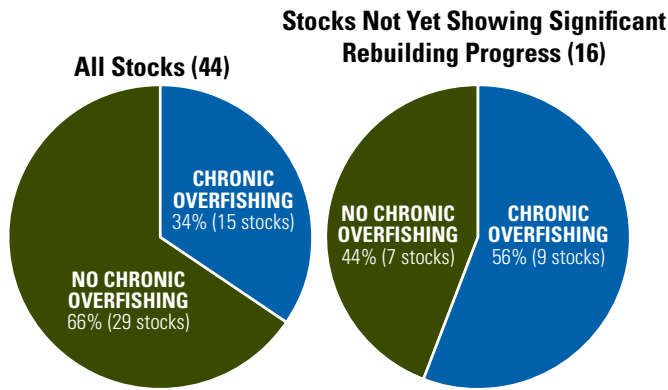
or a lack of rebuilding progress).¹¹ Overfishing occurs when the rate of fishing mortality is unsustainable—that is, when more fish are killed than the stock is able to replenish on an ongoing basis—and thus puts the stock in jeopardy of becoming (or remaining) overfished. Nine, or more than half, of the 16 stocks that have shown limited or a lack of rebuilding progress experienced chronic overfishing during the rebuilding plan (defined as overfishing in at least half of the years the stock has been in a rebuilding plan), compared with 35% of the study group as a whole. Seven of the nine stocks continue to be subject to overfishing, according to the most recent SOS quarterly update report.¹² Chronic overfishing occurred in an even larger portion—5 out of 8—of the stocks demonstrating a lack of rebuilding progress, i.e., that have failed either to increase to 50% of the rebuilding target or to increase at least 25% in abundance since the rebuilding plan's start (see Figure 3). In addition to continued overfishing, reasons for why a stock fails to rebuild as anticipated include delays in reducing fishing mortality, persistently poor recruitment (growth to adult size/age) or increased natural mortality, failure to adequately account for management or scientific uncertainty, failure to adequately account for skewed age distributions, life history complexities, or other species or population characteristics that heighten the stock's vulnerability, food web changes, habitat degradation, large-scale environmental changes such as driven by greenhouse gas emissions, and depensation (this is when population growth per capita declines once population sizes drop below a certain level).¹³

As expected and lending support for the general reasonableness of the 10-year rebuilding period, we found that instances of successful rebuilding were more commonly associated with rebuilding periods of ten years or less. Nineteen of the 21 rebuilt stocks (91%) and 20 of the 28 stocks that are either rebuilt or showing significant rebuilding progress (71%) had time periods for rebuilding of 10 years or less in their plans; if the six long-lived Pacific rockfish, which

have very long rebuilding time periods (averaging almost 42 years), are excluded, 20 of the 22 such stocks that are either rebuilt or showing significant rebuilding progress (>90%) had rebuilding time periods of 10 years or less in their plans. By comparison, only 8 of 15 stocks not yet showing significant rebuilding progress, or a little over 50%, had rebuilding time periods of 10 years or less.¹⁴ We note that stocks with shorter time periods to rebuild may also have certain attributes that make them more amenable to rebuilding efforts, such as high reproductive rate, low fishing pressure, and/or a relatively high population level starting point for rebuilding.

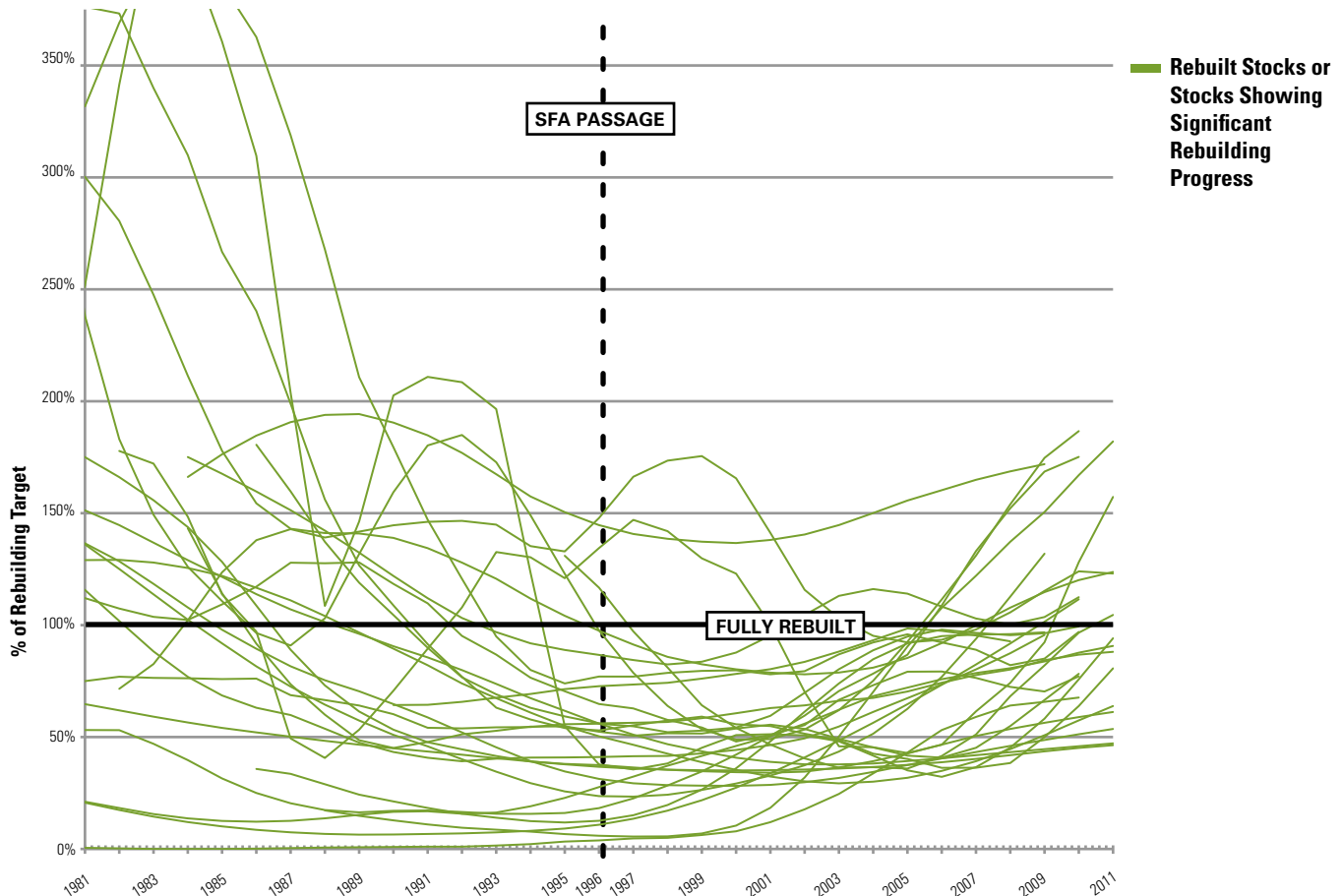
Overall, the population trajectories of the 28 stocks that have been rebuilt or are showing significant rebuilding progress demonstrate that the SFA's passage in 1996 was a catalyst for change. Figure 4 shows population trends over time for these 28 stocks (the vertical axis indicates estimated population level as a percentage of fully rebuilt status (100%)). The population trend lines in these figures show a general temporal relationship between SFA passage in 1996 and stock rebuilding (taking into account a time lag for implementation and population response). Figure 5 shows population trends over time for all 44 stocks in the study group, with the stocks not yet showing significant rebuilding progress added as red lines.

Figure 3: Occurrence of Overfishing During Rebuilding Plans



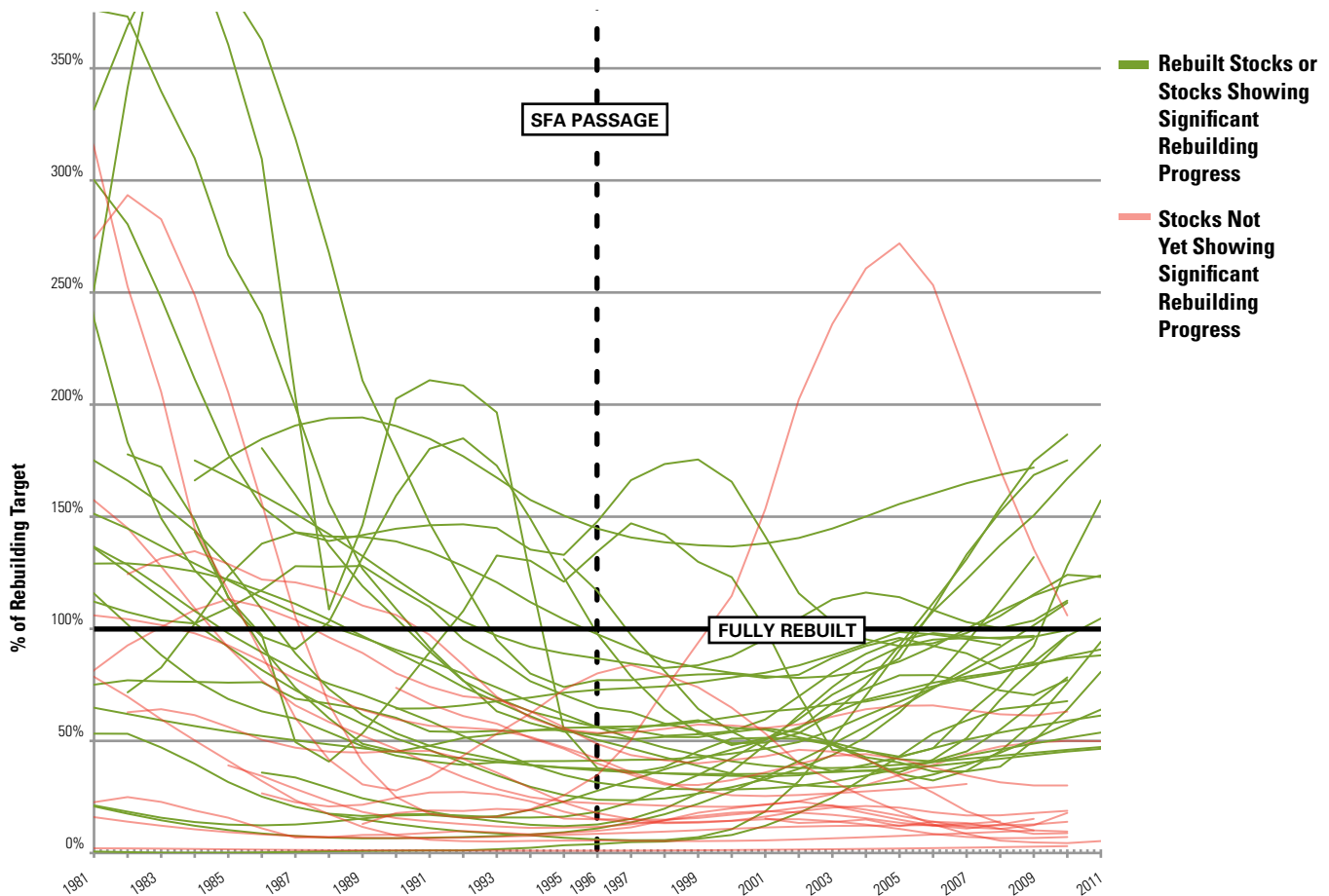
Chronic overfishing = overfishing in $\geq 1/2$ of the years during the rebuilding plan

Figure 4: Population Trends of Rebuilt Stocks and Stocks Showing Significant Rebuilding Progress



Population trends (5-year moving average) for all stocks subject to post-Sustainable Fisheries Act rebuilding plans with sufficient information to evaluate progress under the plans, and that are either rebuilt (and not designated as approaching an overfished condition) or have recovered to at least 50% of the rebuilding target and shown at least a 25% increase in abundance since plan start (28 stocks).

Figure 5: Population Trends of All Stocks in Study Group



Population trends (5-year moving average) for all stocks subject to post-Sustainable Fisheries Act rebuilding plans with sufficient information to evaluate progress under the plans (44 stocks).

Regional Differences in Rebuilding

Significant regional differences exist in how the SFA's rebuilding requirements have been implemented and how successful this implementation has been. The majority of the rebuilding cases (35 out of 44) and an even higher proportion of the stocks that are rebuilt or showing significant rebuilding progress (24 out of 28) are in three fishery management regions: the Mid-Atlantic, New England, and the Pacific.¹⁵ The remaining nine rebuilding cases were spread between the North Pacific, Gulf of Mexico, and South Atlantic regions. None of the 44 rebuilding cases we examined were from the remaining two fishery management regions, the Caribbean and Western Pacific. With respect to the Caribbean specifically, although several reef fish complexes and the queen conch fishery are designated as overfished and have rebuilding plans, there are no recent assessments to determine progress under the plans.¹⁶ This is troubling, as ongoing monitoring of stock status is essential to maintaining rebuilding progress.

It is important to point out that the relative lack of stocks in rebuilding plans in a region does not necessarily mean that the region has few depleted fish stocks. As discussed above, many stocks are listed as having "unknown" status in the SOS reports, and some portion of these are likely depleted and deserving of an "overfished" designation.¹⁷ For example, in the South Atlantic, two stocks, speckled hind and warsaw grouper, are widely recognized to be highly depleted but are formally listed as having "unknown" status.¹⁸ A related concern (also discussed above) exists in the Mid-Atlantic, where the regional fishery management council manages relatively few stocks (only 12) while populations of unmanaged species are known to be depleted. Such species include river herring, shad, and menhaden, which have important ecological roles as forage, including for fish species in federal rebuilding programs.

Figures 6A through 6F show population trends for the 44 stocks in our study group according to region. The horizontal axis indicates implementation progress of the rebuilding plan, with 0 being the first year of implementation.¹⁹ Like Figures 4 and 5, the vertical axis shows stock population level (or the scientists' proxy) as a percentage of fully rebuilt status (100%).

In the **Mid-Atlantic** region (Figure 6A), 5—almost half—of the 12 managed fish stocks were listed as overfished in NMFS's first SOS report in 1997. These included summer flounder, scup, black sea bass, golden tilefish, and bluefish. Spiny dogfish was added to the list the following year. For each of these stocks, the Mid-Atlantic council subsequently developed and implemented a rebuilding plan in order to comply with the SFA. By the early 2000s, the health of scup, black sea bass, tilefish, and bluefish stocks had turned around and was on the upswing; spiny dogfish followed a few years later. In the case of summer flounder, the rebuilding plan served to cement rebuilding progress that had started a few years prior to the plan's implementation.²⁰ Today, five of the stocks have been declared rebuilt (this includes summer flounder, which was designated rebuilt in 2012 but remains a little short of its target biomass, according to the most recent assessment). NMFS lists one stock, tilefish, as above 100% of its rebuilding target but not yet formally rebuilt.

In the **Pacific** region (Figure 6B), two groundfish stocks have been rebuilt and five others—mostly populations of slow-growing types of rockfish species—have been making significant progress under post-SFA rebuilding plans. The

rebuilding of one rockfish stock, cowcod, continues to proceed very slowly, with a 2068 target for rebuilding. The need to reduce bycatch (unwanted catch) in order to rebuild the rockfish stocks has spurred innovations in fishing gear and in information collection, with good results: recent data indicate bycatch of depleted species has dropped significantly.²¹

While it was the collapse of groundfish populations in the **New England** region (Figure 6C) that galvanized support for the SFA's passage in 1996, fishery management troubles in the region have not been limited to groundfish. The 1997 SOS report listed sea scallops, monkfish, southern silver hake, and red hake, as well as five groundfish species (Gulf of Maine cod, American plaice, Southern New England winter flounder, windowpane flounder, and Atlantic halibut), as overfished.²² By the 2000 SOS report, ten more stocks had been added to the list, including seven groundfish stocks and two skate species. Twenty-one of the 44 stocks in our study group—almost half—are from the New England region.

To comply with the SFA, the New England council implemented rebuilding programs for each of these stocks, as well as for Acadian redfish, which was designated as overfished in the 2001 SOS report. In a few cases, such as Georges Bank haddock and sea scallops, the new rebuilding plans built on conservation measures put in place in the several years before, maintaining or accelerating rebuilding that was already underway. Today, 12 of a total of 21 stocks are fully rebuilt or making significant rebuilding progress.²³

Figure 6: Regional Trends in Rebuilding. Population trends (3-year moving average) for study group, i.e., all stocks subject to post-Sustainable Fisheries Act rebuilding plans with sufficient information to evaluate progress under the plans, by region. For rebuilt stocks, time series extended to date of last assessment.

Figure 6A: Mid-Atlantic Region Rebuilding Progress

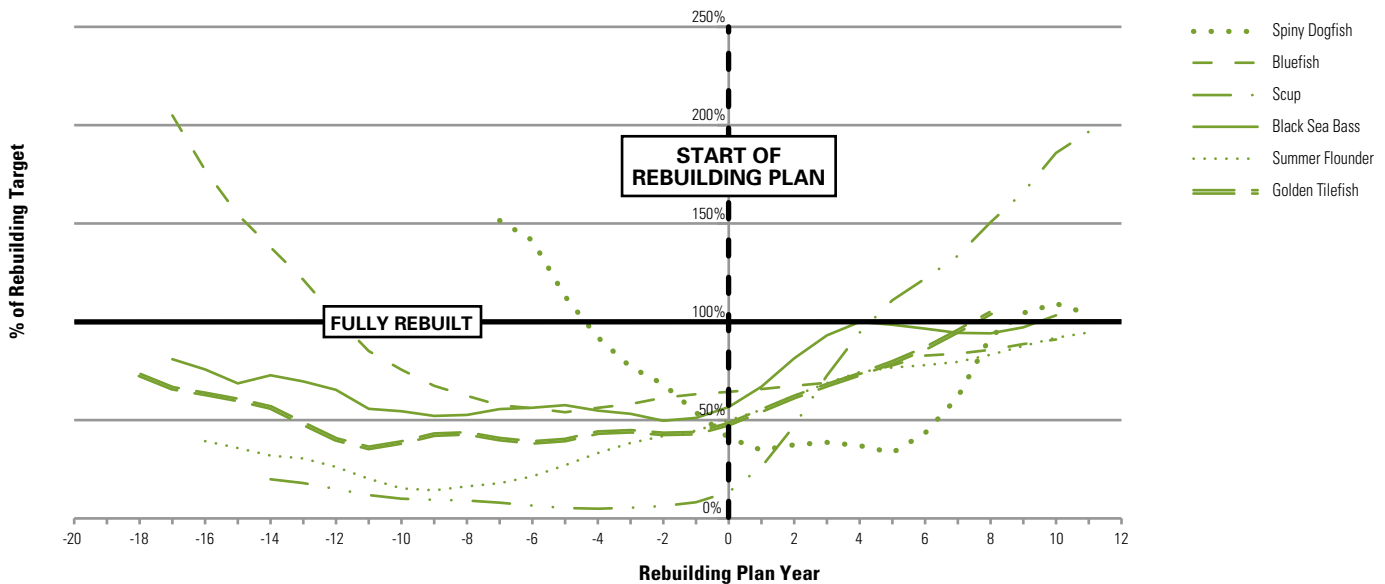


Figure 6B: Pacific Region Rebuilding Progress

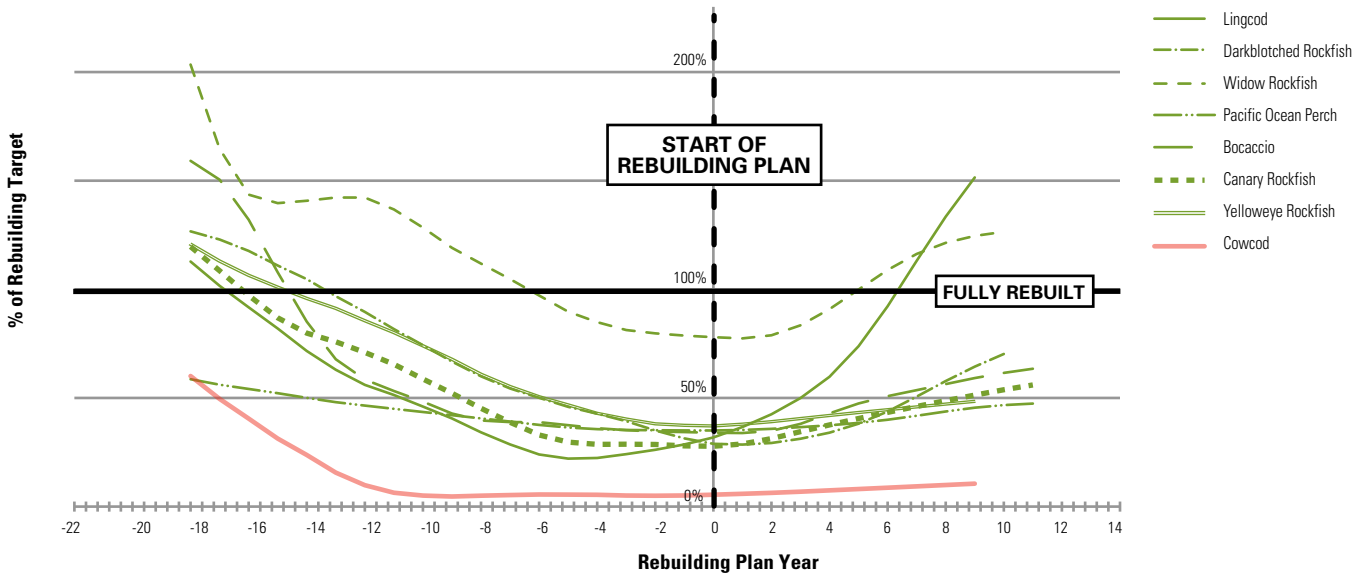
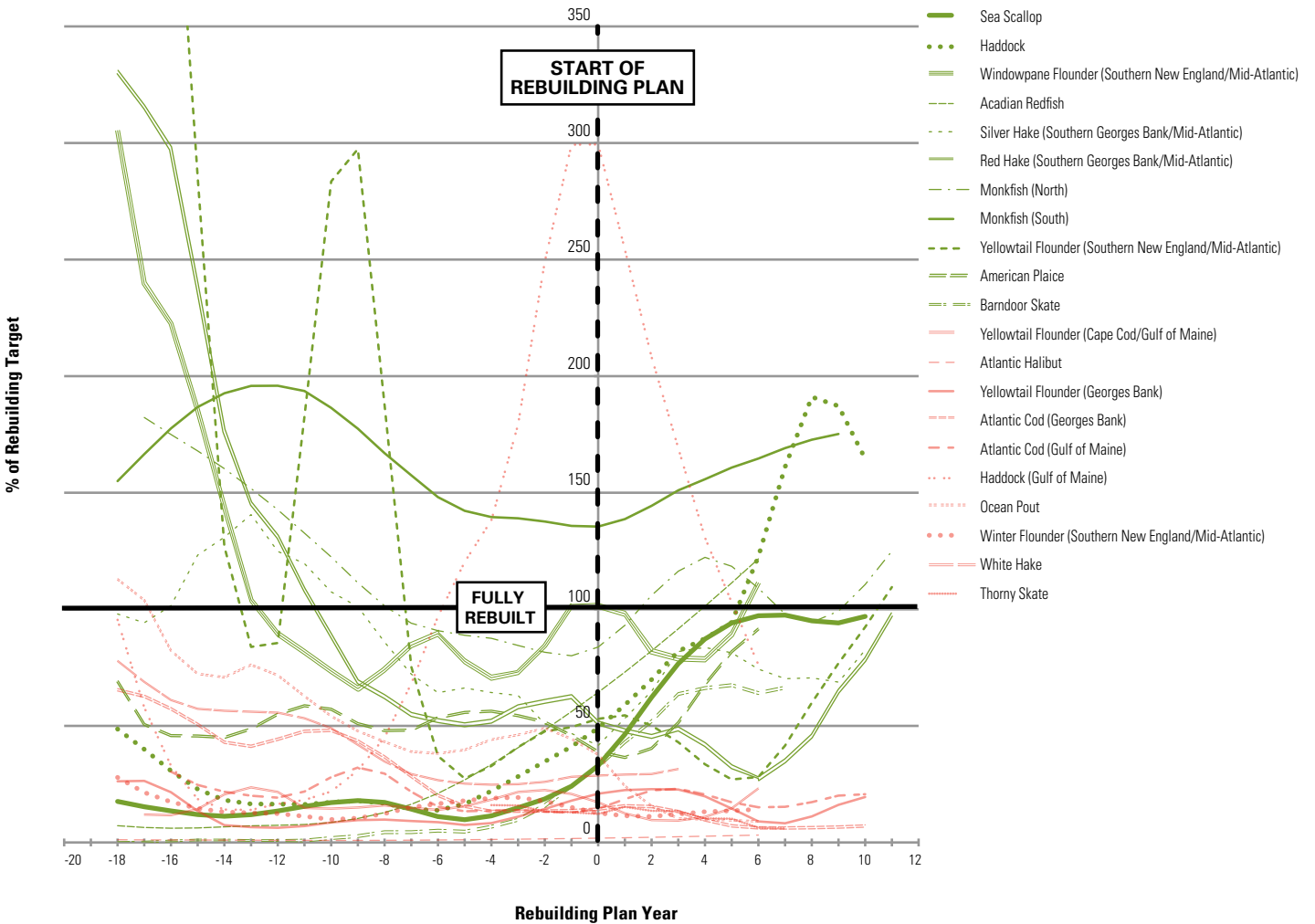


Figure 6C: New England Region Rebuilding Progress



Nine New England stocks with post-SFA rebuilding plans are still struggling to rebuild. Six of these stocks (Georges Bank and Gulf of Maine cod, Cape Cod/Gulf of Maine and Georges Bank yellowtail flounder, Southern New England/Mid-Atlantic winter flounder, and white hake) have been subject to chronic overfishing (>50% of years) during the rebuilding program, which has retarded stock recovery. One stock in the region, Gulf of Maine haddock, was rebuilt but subsequently designated as approaching an overfished condition again (as well as subject to overfishing). The recent implementation of annual catch limits in the region, as required by 2006 amendments to the MSA, is expected to curb the region's overfishing problem. Fishery managers in the region previously utilized catch "targets" for groundfish, which were routinely exceeded.

In the **North Pacific** region (Figure 6D), the SFA's rebuilding requirements have not often come into play, simply because most of the region's plentiful and lucrative fisheries have never dropped below the overfished threshold. Only four crab stocks, out of the dozens of stocks managed by the North Pacific council, have ever been designated as overfished in an SOS report. Three of those—Bering Sea snow crab, St. Matthew Island blue king crab and Bering Sea Tanner crab—have been successfully rebuilt. Pribilof Islands blue king crab remains a dark spot for the region: The most recent SOS report lists the stock as being at only 7% of its rebuilt target in year 9 of a 10-year plan (environmental conditions are believed to be playing a role in the slower than anticipated recovery).

The **South Atlantic** and the **Gulf of Mexico** regions

Figure 6D: North Pacific Region Rebuilding Progress

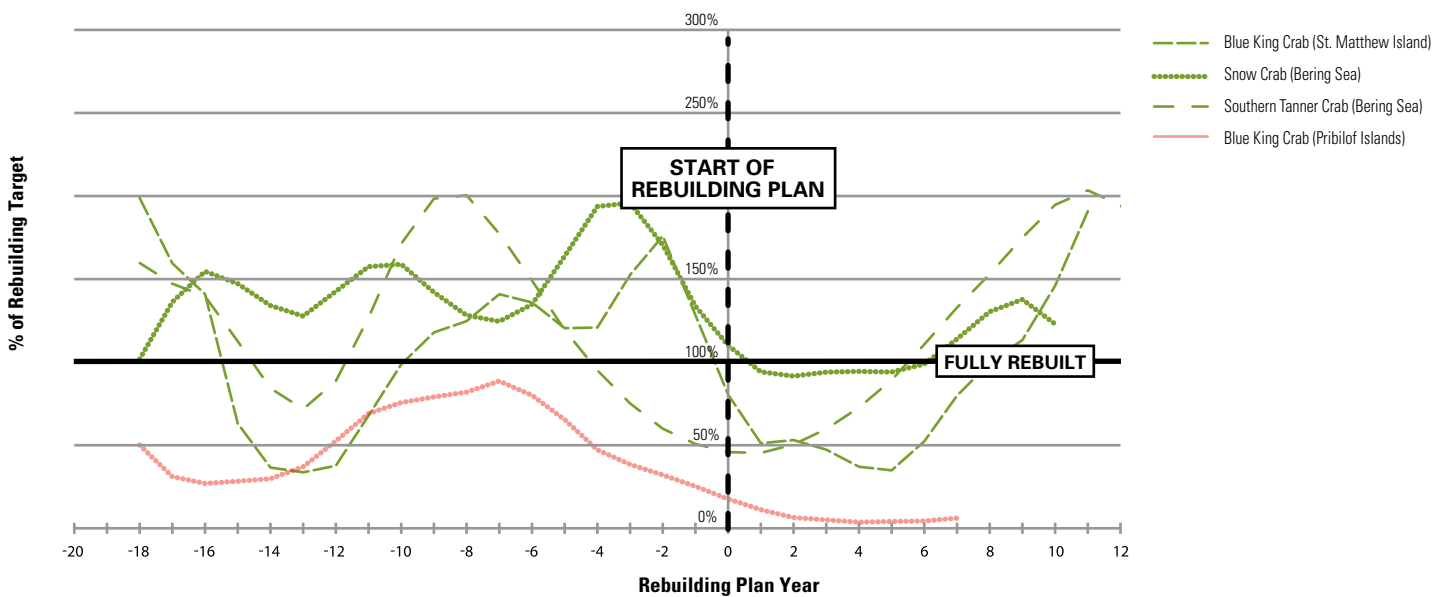


Figure 6E: Gulf Of Mexico Region Rebuilding Progress

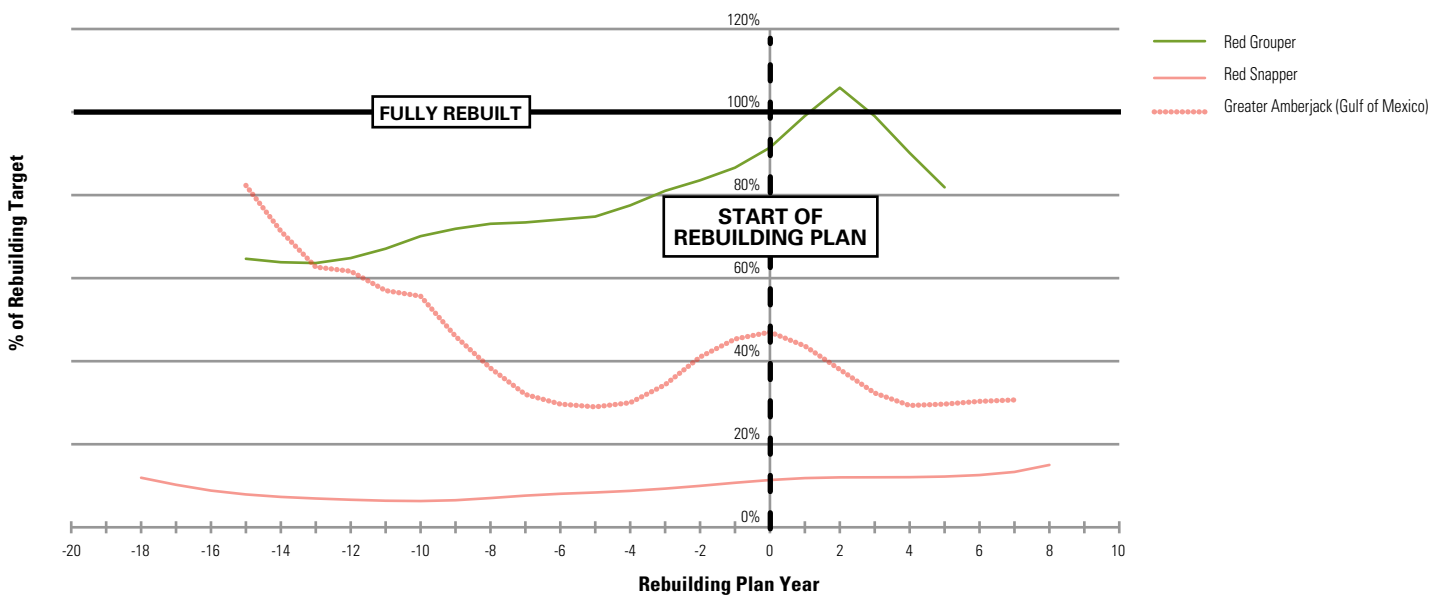
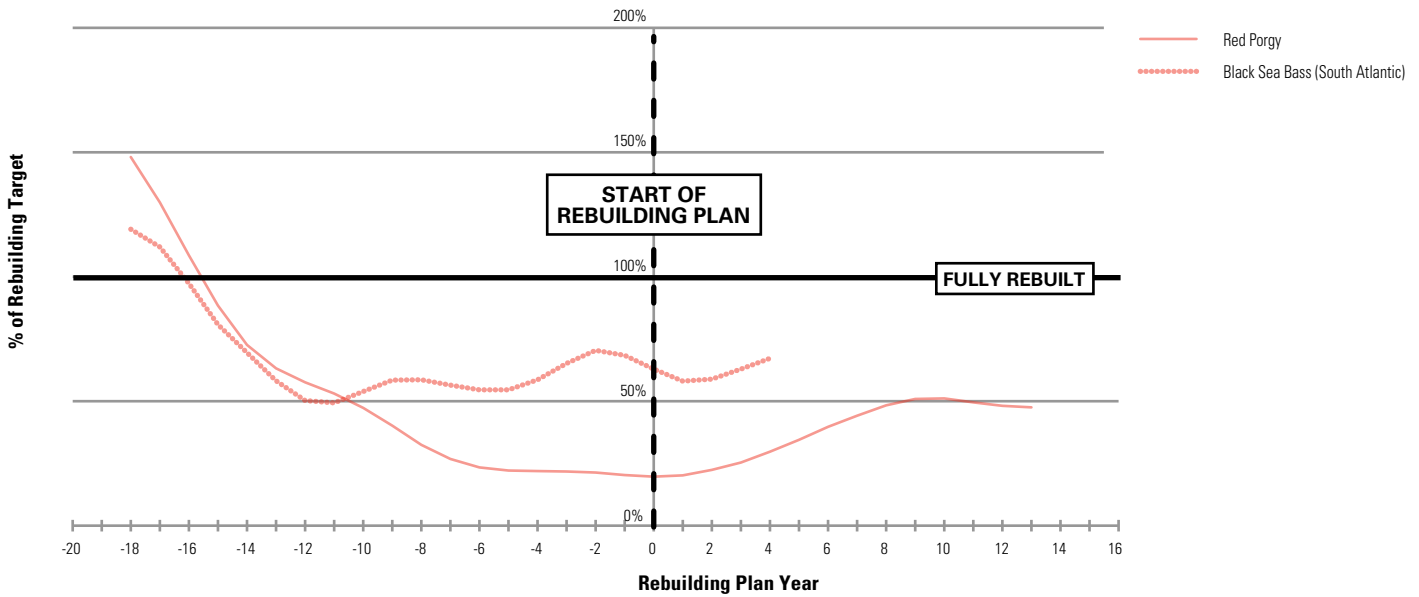


Figure 6F: South Atlantic Region Rebuilding Progress



(Figures 6E and 6F) have been less successful than the regions discussed above in implementing the SFA’s rebuilding requirements. Across the two regions, just one stock has been rebuilt or made significant rebuilding progress. Red grouper in the Gulf was declared rebuilt in 2007. Progress has been more elusive for the four other stocks that have been in rebuilding plans since before 2010: red porgy and black sea bass in the South Atlantic, and greater amberjack and red snapper in the Gulf. There are some indications of progress for South Atlantic black sea bass, which is no longer considered overfished (its estimated 2010 biomass was 70% of the rebuilding target), and for Gulf red snapper and South Atlantic red porgy, both of which have increased more than 25% since the start of rebuilding. While an assessment is in the works for Gulf red snapper and preliminary indications are that the stock’s status is improved, an assessment of South Atlantic red porgy released in fall 2012 indicates that this stock’s rebuilding has stalled out.

The recreational fisheries in the South Atlantic and Gulf of Mexico have grown significantly over the past several decades and now frequently dwarf their commercial counterparts. The regions are just beginning to reconcile the challenges of this increasing fishing pressure with a finite resource that has been historically overexploited. For example, the number of angler trips in the South Atlantic has grown from just under 15 million per year on average in the 1980s to 17 million per year in the 1990s to more than 20 million per year in the period since then. Given the low population levels and high vulnerability to overfishing of many species in these regions, ending overfishing and rebuilding populations have been serious challenges in the face of such a substantial increase in fishing.

Tuna Troubles

A number of migratory fish stocks that are caught in U.S. waters are subject to management under international agreements. The MSA contains an exception to the 10-year rebuilding requirement when management measures under international agreements dictate otherwise. Though multiple factors are at play, this weaker approach to rebuilding has not proved a conservation success: Of the 19 Atlantic highly migratory species of known status managed by NMFS, including multiple tuna, billfish, and shark stocks and stock complexes, 8 are overfished and 1 is approaching an overfished condition—about half of the total. One relative bright spot is North Atlantic swordfish, which, after becoming overfished by the late 1990s, was put into a rebuilding plan and ultimately declared rebuilt in 2009.



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BENEFITS OF REBUILDING

Healthy fish populations are essential for healthy marine ecosystems. According to numerous scientific studies as well as the reports of two national ocean commissions—the U.S. Commission on Ocean Policy and the Pew Oceans Commission—depletion of fish populations as a result of overfishing is a leading threat to our ocean ecosystems.²⁴ Highly depleted fish populations have a greater risk of long-term collapse and are more vulnerable to such threats as climate change, ocean acidification, and invasive species.²⁵ By maintaining robust fish populations, we can help ensure that our ocean ecosystems stay strong and resilient into the future.

Healthy fish populations are also essential for healthy fishing economies. Rebuilt stocks—such as the 21 in our study group that have been rebuilt under post-SFA rebuilding plans—can provide a much higher sustainable yield than depleted stocks. Abundant fish populations have at least two further economic benefits: They can be caught more efficiently (with less effort) and, if managed properly, can produce more stable catch levels.

To gauge the economic impacts of rebuilding, we examined gross annual commercial revenues (often called “ex-vessel” or “dockside” revenues) for the 28 stocks identified in this report as rebuilt or showing significant rebuilding progress. Specifically, we compared average revenues from the three-year period 2008–2010, the most recent period with data available for all 28 stocks, to average revenues from the three-year period following each stock’s designation as overfished in a SOS report.²⁶ We note that gross revenues from commercial landings are an incomplete measure of economic benefit, as they do not account for changes in costs—such as higher fuel expenditures or increases in fishing efficiency—which can affect net profit. Even net commercial profit would be an incomplete measure, as it does not capture other economic benefits from rebuilding marine fisheries, including revenue from recreational fishing (discussed below); from diving, wildlife viewing, photography, and similar non-extractive activities; and from healthier ecosystems and greater biodiversity.

We found that total gross commercial revenues for the 28 rebuilding “success-story” stocks—with New England sea scallops leading the way—grew from an estimated annual average of approximately \$300 million during the three years following the stocks’ designation as overfished to an estimated annual average of approximately \$580 million during the 2008–2010 period, corresponding to an increase of 92%, or 54% after adjusting for inflation (see Table 1).²⁷ (In New England, gross commercial revenues for groundfish and scallops rose another 25% between just 2010 and 2011.)²⁸ By comparison, overall estimated annual average gross commercial revenues from landings of all stocks (not just the 28 “successes”) in the regions under study (New England, Mid-Atlantic, South Atlantic, Gulf, Pacific, and North Pacific) showed only a 27% increase (–4% after adjusting for inflation) between the three-year period of 1997–1999 (the period following the SFA’s enactment, during which many of the rebuilding plans were initially implemented) and the three-year period of 2008–2010.²⁹

Complete rebuilding of all U.S. stocks (not just the 44 stocks discussed in this report) will boost economic benefits significantly higher. NMFS has estimated that complete rebuilding of all U.S. stocks will ultimately increase fishermen’s dockside revenues by \$2.2 billion a year—a 50% increase from 2010 revenues. Taking into account multiplier effects (such as activities of processors, wholesalers, retailers, and restaurants), NMFS estimates that the total sales impact could be \$31 billion and that 500,000 jobs could be created.³⁰

Table 1: Change in Gross Commercial Revenues From Rebuilding “Success Stories.”

| Estimated annual gross commercial revenue (from 28 stocks identified as rebuilt or showing significant rebuilding progress). | | |
|--|-------------------|---|
| Start of rebuilding ^a | Average 2008-2010 | % change (inflation-adjusted ^b) |
| \$305,271,000 | \$584,687,000 | +92% (+54%) |

a. Represented by average of the first three years following the stock’s listing as overfished in a SOS report.

b. Adjusted by Consumer Price Index.

Recreational anglers have also benefited from rebuilding. According to the National Oceanic and Atmospheric Administration, saltwater anglers spent more than \$19.5 billion in 2009, taking 75 million fishing trips, supporting more than 327,000 jobs, and contributing an overall \$73 billion to the nation’s economy.³¹ Recreational fishing, as measured by the number of fishing trips, has grown by nearly 30% over the past two decades; anglers along the Atlantic coast as a whole took 12 million more fishing trips per year in the past decade than they did in the 1980s.

The rebuilding of important sport-fish populations has been critical to this success. Take the Mid-Atlantic region, for example, where some of the most important recreational fisheries in the country are found. The number of recreational angler trips in the Mid-Atlantic increased by nearly one-third (from 15 million to nearly 20 million trips) from the average during the period 1990–1999, when populations of popular species were depleted, to the average from 2000–2010, even as fish species were recovering to healthy levels. By 2011, the catch of summer flounder had climbed to 21.5 million fish from 2.7 million in 1989. To enable the species to rebuild, anglers were limited to keeping roughly the same number of fish (1.7 million fish in 1989 and 1.8 million in 2011), but the “keepers” today are about twice the size, meaning the overall weight of summer flounder landed by recreational fishers in 2011 was nearly two times that of 1989 (5.9 million pounds to 3.2 million pounds). A similar trend exists for scup, another popular Mid-Atlantic species, which hit an all-time population low in 1995, estimated at 4% of its healthy level. From 1995 to 1999, recreational anglers caught just under 3.8 million scup per year, but since 2000 they have



averaged more than 10 million per year as the stock has recovered. Landings (fish caught and kept) also more than doubled, from less than 2.4 million scup per year in the late 1990s to more than 4.8 million since 2000. The population is now estimated to be above its fully rebuilt level, so fishery managers increased the recreational harvest limit in 2012 to more than 8.4 million pounds.³²

The growth in recreational fishing, including catch-and-release fishing, spurred by healthier fish populations in the Mid-Atlantic region is proving a strong economic driver. According to NOAA Fisheries' most recent estimates of the economic contribution of marine recreational anglers, the increased number of angler trips from the 1990s to the 2000s

in the Mid-Atlantic amounted to an additional \$1.4 billion in economic activity and 18,660 jobs.³³ Without rebuilding, these economic benefits likely would not have been realized—fewer fishermen will choose to go out for a day on the water when stocks are depleted and catches are weak. To the south, the failure to rebuild three popular recreational species in the South Atlantic and Gulf of Mexico regions—red snapper and black sea bass in the South Atlantic and red snapper in the Gulf—was estimated to have reduced expenditures by recreational anglers in the 2005-2009 period by more than 110%, to an estimated \$154 million annually, with the loss of an additional \$213 million in annual economic output and almost 1,400 jobs.³⁴

For the past half-dozen years, bills with names like the Flexibility in Rebuilding American Fisheries Act have been introduced in Congress. These bills target the MSA’s requirement that depleted fish populations be rebuilt in a time period that is “as short as possible,” not to exceed 10 years (with exceptions to account for biological differences in fish species, international agreements, or environmental factors). The bills’ sponsors claim that the 10-year time period is arbitrary and that the requirement is generally too inflexible. Neither complaint has merit.

With respect to arguments that the 10-year time period is arbitrary, it has been shown that the great majority of marine fish populations have the biological potential to be rebuilt within that period.^a Moreover, when rebuilding in 10 years is not biologically possible, the MSA provides an explicit exception; it also provides 2 years for plan development and implementation. Our evaluation of rebuilding indicates that the 10-year time frame has, in fact, worked well for rebuilding many stocks. As discussed earlier in the text, 19 of the 21 rebuilt stocks (91%), and 20 of the 28 stocks that are either rebuilt or showing significant rebuilding progress (71%), had time periods for rebuilding of 10 years or less in their plans. By comparison, only 8 of 15 stocks not yet showing significant rebuilding progress (53%) had rebuilding time periods of 10 years or less (this does not include Gulf of Maine haddock, which was rebuilt but subsequently designated as approaching an overfished condition).

Managers have also implemented the rebuilding requirements in a flexible fashion—sometimes to the detriment of the rebuilding process, as this evaluation shows. For many of the 44 stocks we evaluated, managers set rebuilding time periods longer than 10 years, relying on the statutory exception for when it is not biologically possible to rebuild a stock in 10 years (see Figure 7). Fifteen of the stocks in our study set had designated rebuilding time periods greater than 10 years, with an average rebuilding time period of 19.6 years for the group of 43 stocks (all except Gulf of Maine haddock). When the exception was not used, managers chose the full 10-year maximum period in the overwhelming majority of cases, despite the statutory directive that the time period for rebuilding be “as short as possible.” Delays of 3+ years in the start dates of rebuilding plans have also unfortunately been common (see Figure 8).^b When implementation delays are considered, the average rebuilding time period for the 43 stocks jumped to 23 years. We found that the average time lag from date of overfished designation to rebuilding plan implementation was 2.7 years for stocks that are rebuilt or showing significant rebuilding progress compared to 4.5 years for stocks that are not yet showing significant rebuilding progress.

Figure 7: Distribution of Rebuilding Time Periods.

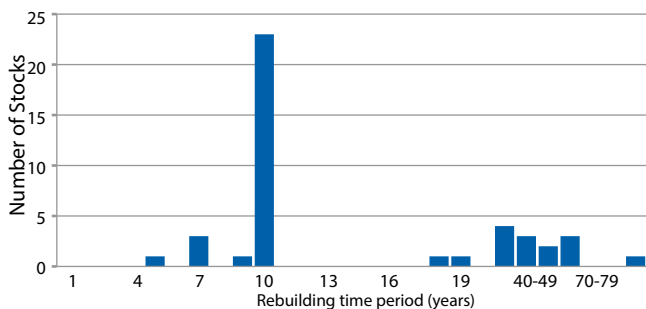
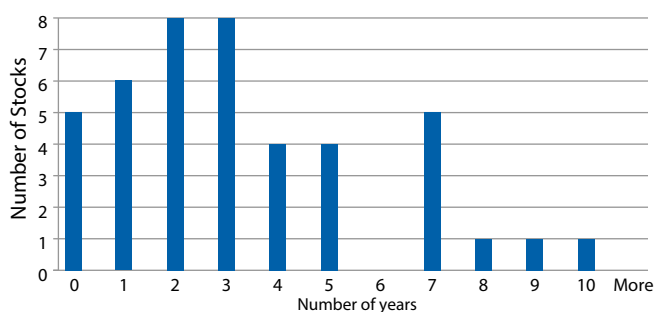


Figure 8: Time Lags in Implementation. Shows Number of Years Between Overfished Stock Designations and Implementation of Rebuilding Plans; If Multiple Plans, Depicts Time Period to Most Recent Plan



The “rebuilding flexibility” bills would gut the MSA’s rebuilding requirements, including by:

- deleting the mandate requiring that the rebuilding time period be “as short as possible” and replacing it with “as short as practicable”;
- allowing managers to set the initial rebuilding deadline longer than 10 years whenever “appropriate” because of “environmental conditions,” among other factors; and
- allowing managers to extend the rebuilding deadline repeatedly, including whenever they:
 - can claim that factors in addition to fishing are causing the decline, or
 - can point to some evidence of a “positive rebuilding trend” for certain categories of stocks, or
 - decide to change (even decrease) the rebuilding target.

a. Carl Safina et al., “US Ocean Fish Recovery: Staying the Course,” *Science* (July 29, 2005): 707-08.

b. Andrew A. Rosenberg et al., “Rebuilding US fisheries: Progress and Problems,” *Frontiers in Ecology and the Environment*, (Aug. 2006): 303-308 (the authors were particularly critical of delays caused when managers “reset the clock,” or start a new rebuilding period, when rebuilding targets change or when managers claim there is other significant new information).

CONCLUSION

The rebuilding requirements enacted into law as part of the Sustainable Fisheries Act of 1996 have been generally effective in rebuilding depleted U.S. ocean fisheries. We examined the rebuilding histories of all U.S. fish stocks that have been subject to rebuilding plans following enactment of the Sustainable Fisheries Act and for which adequate information was available to evaluate progress under these plans—a total of 44 stocks. Of these 44 stocks, 28 stocks, or 64%, have been rebuilt or are showing significant rebuilding progress, as defined in this report. Twenty-one of the stocks—close to half—have been designated rebuilt (and not again designated as approaching an overfished condition) or have achieved their rebuilding target. Although each stock has its own unique management and biological history, positive population trends for the 28 stocks are generally associated with the several years following the SFA's passage in 1996, during which its requirements became widely implemented around the country. Positive population trends were also generally associated with implementation of rebuilding plans. These results show that the legal requirements have been a critical forcing mechanism for fisheries rebuilding in this country. The fourth quarter 2012 SOS update report shows that, of all stocks or stock complexes for which an overfished determination could be made (219 stocks), 41 or 19% are overfished, the lowest percentage ever reported by NMFS.³⁵ Another 12 stocks are no longer formally designated as overfished but are still below their rebuilding target.³⁶

This country's success in rebuilding its fisheries is particularly notable when compared with the generally dismal trends in fisheries management globally. Declining global fisheries were estimated by the World Bank in 2009 to cost \$50 billion annually in direct net benefits from commercial fisheries alone.³⁷ One study of assessed stocks globally found 63% to be in need of rebuilding (or below the biological target known as B_{msy} ; see inset box "Rebuilding Under the MSA: A Technical Primer," p.4), compared to 24% of U.S. stocks that are either formally overfished, e.g., less than 50% of the biological target, or no longer overfished but still below the biological target.³⁸ Although there are relative exceptions, many developed nations, such as those in the European Union (EU), continue to lag in controlling overfishing and rebuilding fish populations. According to the European Commission, 44% of assessed Northeast Atlantic stocks are overfished.³⁹ Another report lists the number of European stocks overall and Southern European stocks that are below B_{msy} as 70% and almost 90% respectively.⁴⁰ EU catches are also reported to have declined an average of 2% per year from 1993-2008, resulting in a 25% drop in revenues over that period.⁴¹ By contrast, U.S. commercial fishermen landed more than 10 billion pounds of seafood worth more than \$5 billion in 2011; these landings represent the highest overall commercial landings since 1994.⁴²

Our analysis did expose some areas of concern:

- Certain categories of stocks appear to be falling through the cracks—that is, evading a robust application of the MSA's rebuilding requirements. Depleted internationally managed stocks are exempted from the MSA's 10-year time period requirement. Certain depleted stocks caught in federal waters, like river herring in the Mid-Atlantic, are entirely exempted from the MSA's rebuilding requirements because managers have chosen not to put them under formal federal management. Many other stocks languish with officially "unknown" status, including stocks, such as speckled hind and warsaw grouper in the South Atlantic, that have previously been recognized as significantly depleted.
- Overfishing continued to occur on some stocks in rebuilding plans, and chronic overfishing (overfishing in more than 50% of the rebuilding plan years) is associated with a high percentage of stocks in our study group that have yet to make significant rebuilding progress. Alerted to this general problem during the most recent reauthorization of the MSA in 2006, Congress amended the law to require an immediate end to overfishing for stocks in rebuilding plans and that all councils implement annual catch limits that prevent overfishing. Implementation of annual catch limits in all fisheries subject to overfishing was required by 2010. This evaluation demonstrates that managers will need to remain vigilant in ending overfishing of stocks in rebuilding plans and in preventing overfishing of stocks once they are rebuilt.
- Rebuilding programs are simply not working for certain stocks. Particular attention should be paid to the eight stocks (Georges Bank cod, Gulf of Maine cod, ocean pout, Southern New England/Mid Atlantic winter flounder, white hake, thorny skate, Gulf of Mexico greater amberjack, and Pribilof Islands blue king crab) that remain below the overfished threshold and have yet to increase at least 25% in abundance, despite rebuilding plans that stretch back almost a decade (and, in some cases, longer). If rebuilding plans had been more precautionary for these stocks, particularly in initial years, rebuilding efforts might have been more successful in at least some instances.
- Some regions, such as New England, the Gulf of Mexico, and the South Atlantic, are struggling more than others to rebuild their fish stocks.
- It is critical to consistently track the progress of stocks in rebuilding plans towards their rebuilding targets and to adjust management measures throughout plan implementation (and not simply near the end) as necessary to stay on track. Some regions, such as the Caribbean, have a high proportion of overfished stocks that lack recent assessments to gauge how much rebuilding progress is occurring. Generally speaking, regions with a fair amount of rebuilding success, such as the Mid-Atlantic and the Pacific regions, have historically more regularly monitored rebuilding progress and taken corrective action when needed compared to regions that have had less success, such as New England, the South Atlantic, and the Gulf of Mexico.



We want to emphasize that rebuilding the biomass of depleted fisheries is only one piece of successful fisheries management and the protection of marine ecosystem health. The Magnuson-Stevens Act and other laws also call for protection of sensitive marine habitat; minimization of bycatch (unwanted catch) of fish, marine mammals, sea turtles, and seabirds; and consideration of ecological needs, such as an adequate forage base, in managing fish populations. Simply because the biomass of a fishery has been rebuilt does not necessarily mean that management of the fishery is succeeding with respect to these other goals. It is fair to say that the MSA has spurred much greater efforts to rebuild depleted fish populations and to end overfishing than it has spurred efforts to, for example, protect important or sensitive marine habitat. The next reauthorization of the statute will need to address these other priorities if the country is to achieve a holistic fisheries management program that both protects marine ecosystem health and provides for healthy fish populations.

The story of U.S. fisheries rebuilding in this country is not yet complete. Work remains to be done, particularly with respect to stocks that continue to struggle to rebuild, and with respect to certain regions that have lagged in rebuilding. It needs to be determined whether systemic improvements to our rebuilding efforts beyond ending overfishing (the requirements for which were recently tightened) are needed to address these shortcomings. We must also address the large number of stocks that remain unassessed, as well as other identified categories of stocks that are evading rebuilding efforts. Finally, rebuilt and healthy stocks must not be allowed to be subject to overfishing and put at risk of becoming overfished. At the same time, as this evaluation shows, significant—indeed historic—progress has been made in rebuilding our nation’s fisheries. This progress should be recognized and safeguarded for future generations.

APPENDIX A

Table 1A: Status of U.S. Stocks With Post-SFA Rebuilding Plans. Stocks listed have sufficient information available to evaluate progress under their rebuilding plans.

| Stock | Region | Start of Rebuilding Plan ^{a,b} | Rebuilding time period | Chronic over-fishing ^c (Yes/No) | Rebuilding Status |
|---|---------------------------|---|------------------------|--|--|
| Designated Rebuilt or Achieved Rebuilding Target | | | | | |
| Sea Scallop | New England | 1999 | 10 | Y | Rebuilt |
| Haddock (Georges Bank) | New England | 2000/2004 | 10 | N | Rebuilt |
| Windowpane Flounder (Southern New England/Mid-Atlantic) | New England | 2004 | 10 | N | Rebuilt |
| Acadian Redfish | New England | 2004 | 47 | N | Rebuilt |
| Silver Hake (Southern Georges Bank/Mid-Atlantic) | New England | 2000 | 10 | N | Rebuilt |
| Red Hake (Southern Georges Bank/Mid-Atlantic) | New England | 2000 | 10 | N | Achieved rebuilding target ^d |
| Yellowtail Flounder (Southern New England/Mid-Atlantic) | New England | 2000/2004 | 10 | Y | Rebuilt |
| Monkfish (North) | New England/ Mid-Atlantic | 1999 | 10 | Y | Rebuilt |
| Monkfish (South) | New England/ Mid-Atlantic | 1999 | 10 | N | Rebuilt |
| Spiny Dogfish | Mid-Atlantic | 2000 | 5 | N | Rebuilt |
| Bluefish | Mid-Atlantic | 2001 | 9 | N | Rebuilt |
| Scup | Mid-Atlantic | 2000/2007 | 7 | N | Rebuilt |
| Black Sea Bass (Mid-Atlantic) | Mid-Atlantic | 2000 | 10 | Y | Rebuilt |
| Summer Flounder | Mid-Atlantic | 2000 | 10 | Y | Rebuilt (95%) |
| Golden Tilefish (Mid-Atlantic) | Mid-Atlantic | 2001 | 10 | N | Achieved rebuilding target ^e |
| Red Grouper (Gulf of Mexico) | Gulf of Mexico | 2003 | 10 | N | Rebuilt |
| Lingcod | Pacific | 2000 | 10 | N | Rebuilt |
| Widow Rockfish | Pacific | 2001 | 34 | N | Rebuilt |
| Blue King Crab (St. Matthew Island) | North Pacific | 2000 | 10 | Unavail. | Rebuilt |
| Snow Crab (Bering Sea) | North Pacific | 2001 | 10 | N | Rebuilt |
| Southern Tanner Crab (Bering Sea) | North Pacific | 2000 | 10 | N | Rebuilt |
| Significant Rebuilding Progress | | | | | |
| American Plaice | New England | 2004 | 10 | N | Not overfished/ >25% increase since plan start ⁹ |
| Barndoor Skate | New England | 2003 | 21 | N | Not overfished/ >25% increase since plan start |
| Darkblotched Rockfish | Pacific | 2001 | 27 | N | Not overfished/ >25% increase since plan start |
| Pacific Ocean Perch | Pacific | 2000 | 43 | N | Not overfished/ >25% increase since plan start ^h |
| Bocaccio (Southern Pacific Coast) | Pacific | 2000 | 34 | N | Not overfished/ >25% increase since plan start |
| Canary Rockfish | Pacific | 2000 | 57 | N | Not overfished/ >25% increase since plan start |
| Yelloweye Rockfish | Pacific | 2002 | 54 | N | Not overfished/ >25% increase since plan start |

Table 1A: Status of U.S. Stocks With Post-SFA Rebuilding Plans. Stocks listed have sufficient information available to evaluate progress under their rebuilding plans.

| Stock | Region | Start of Rebuilding Plan ^{a,b} | Rebuilding time period | Chronic over-fishing ^c (Yes/No) | Rebuilding Status |
|---|----------------|---|------------------------|--|---|
| Limited Rebuilding Progress | | | | | |
| Yellowtail Flounder (Cape Cod/Gulf of Maine) | New England | 2004 | 19 | Y | Remains overfished/ >25% increase since plan start |
| Atlantic Halibut | New England | 2004 | 52 | N | Remains overfished/ >25% increase since plan start |
| Yellowtail Flounder (Georges Bank) | New England | 2000/2006 | 7 | Y | Remains overfished/ >25% increase since plan start |
| Haddock (Gulf of Maine) | New England | 2004 | N/A | N | Rebuilt (2011) but subsequently determined to be approaching overfished condition |
| Black Sea Bass (South Atlantic) | South Atlantic | 2006 ^d | 10 | Y | Not overfished/ <25% increase since plan start |
| Red Porgy (South Atlantic) | South Atlantic | 1999 | 18 | N | Remains overfished/ >25% increase since plan start |
| Red Snapper (Gulf of Mexico) | Gulf of Mexico | 2000/2005 | 31 | Y | Remains overfished/ >25% increase since plan start |
| Cowcod (Southern California) | Pacific | 2000 | 95 | N | Remains overfished/ >25% increase since plan start |
| Lack of Rebuilding Progress | | | | | |
| Atlantic Cod (Georges Bank) | New England | 2000/2004 | 22 | Y | Remains overfished/ <25% increase since plan start |
| Atlantic Cod (Gulf of Maine) | New England | 2000/2004 | 10 | Y | Remains overfished/ <25% increase since plan start |
| Ocean Pout | New England | 2004 | 10 | N | Remains overfished/ <25% increase since plan start |
| Winter Flounder (Southern New England/Mid-Atlantic) | New England | 2004 | 10 | Y | Remains overfished/ <25% increase since plan start |
| White Hake | New England | 2004 | 10 | Y | Remains overfished/ <25% increase since plan start |
| Thorny Skate | New England | 2003 | 25 | N | Remains overfished/ <25% increase since plan start |
| Greater Amberjack (Gulf of Mexico) | Gulf of Mexico | 2003 | 7 | Y | Remains overfished/ <25% increase since plan start |
| Blue King Crab (Pribilof Islands) | North Pacific | 2004 | 10 | N | Remains overfished/ <25% increase since plan start |

a. Where two years are listed, two rebuilding plans (complete or partial) were implemented for this stock.

b. Rebuilding plan implemented at the beginning of, or during, the listed year.

c. Chronic overfishing is defined as overfishing in at least 50% of rebuilding plan years.

d. Never formally designated as rebuilt in SOS report; treated as a rebuilt stock in this report.

e. Not yet designated as rebuilt in SOS report; treated as a rebuilt stock in this report.

f. "Not overfished" means that biomass (or biomass proxy) \geq 50% of rebuilding target.

g. NMFS recently notified the New England Fishery Management Council that American plaice is making insufficient rebuilding progress because the most recent assessment update indicates that the stock cannot rebuild by its target date of 2014. Nevertheless, we list the stock as having made significant rebuilding progress because it is no longer overfished and has increased in abundance by more than 25% since the plan's start, which are our quantitative criteria for this classification (our criteria do not directly address the speed of rebuilding). Based on the most recent stock assessment update, the stock is estimated to be at 59% of its rebuilding target if a correction is made for a retrospective pattern in the assessment (an inconsistency that shows up as more years of data is collected); without the correction, the estimated stock level is at 96% of the target. In response to NMFS's notification, the fishery management council is required to institute corrective management measures.

h. Pacific ocean perch was estimated to be at 48% of its rebuilding target in 2011, with an upward population trend.

i. "Remains overfished" means that biomass (or biomass proxy) <50% of rebuilding target.

j. A rebuilding plan described as a "pre-SFA" plan by the SOS reports was implemented for this stock in 2000.

APPENDIX B: ADDITIONAL INFORMATION ON METHODOLOGY

I. COMPOSING STUDY GROUP OF STOCKS

A. Identification of all federally-managed stocks that have ever been listed as overfished in a NMFS “Status of Stocks” (SOS) report to Congress.

1. DEFINITION OF “LISTED AS OVERFISHED”: For our purposes, the term “overfished” encompassed three distinct designations in the SOS reports: (a) “overfished,” (b) “no – rebuilding,” and (c) “rebuilt.” ATLANTIC STATES
2. MARINE FISHERIES COMMISSION (ASMFC) STOCKS: Stocks currently managed by ASMFC were only included if they were federally-managed at some point between 1997 and the present, and were also designated overfished at some point in a SOS report. This was the case for Red Drum (South Atlantic (SA)).
3. SUBSEQUENT CORRECTIONS: If a stock was listed in a SOS report as overfished, but then subsequently changed to not overfished with an explanatory note indicating the previous overfished designation was a mistake, the later note was treated as superseding the earlier designation, and the stock was not included. This was the case with Loligo Squid (Mid-Atlantic (MA)).
4. STOCKS ERRONEOUSLY LISTED AS OVERFISHED BUT NOT CORRECTED: If a stock was listed as overfished in a SOS report but management documents indicate that listing was in error, then the stock was not included in our list even if subsequent SOS reports failed to explicitly correct the error. This was the case with Northern Silver Hake, which was listed at one point as “overfished” when, according to the relevant fishery management plan amendment and stock assessment, it was only approaching an overfished condition.
5. PRE-SUSTAINABLE FISHERIES ACT (SFA) CRITERIA ONLY: If a stock was listed as overfished only under pre-SFA criteria, it was still included. This was the case for Vermilion Snapper (SA), Goliath Grouper (SA) (later consolidated with GOM), Nassau Grouper (SA), Black Grouper (SA), Gag Grouper (SA), Warsaw Grouper (SA), Speckled Hind (SA), Red Drum (SA) (later transferred to ASMFC mgmt), Yellowtail Snapper (SA) (later consolidated with Gulf of Mexico (GOM)), Nassau Grouper (GOM), Goliath Grouper (GOM) (later consolidated with SA), Red Drum (GOM), Pacific Sardine, Pacific (Chub) Mackerel, Chinook Salmon (Columbia Upriver Summer), Chinook Salmon (Columbia Upriver Spring), Chinook Salmon (Columbia Snake Spring/Summer), Chinook Salmon (Columbia North Lewis Fall), Chinook Salmon (Skagit Spring), Chinook Salmon (Skagit Summer/Fall), Chinook Salmon (Stillaguamish Summer/Fall), Chinook Salmon (Cedar Summer/Fall Lake Washington), Chinook Salmon (Dungeness River), Chinook Salmon (Snohomish Summer/Fall), Chum Salmon, and the Hawaii Bottomfish Complex.
6. CONSOLIDATION / SPLITTING OF STOCKS: When one stock was split into two, or two stocks consolidated into one, all of the components were included, so long as at least one of the components (pre- or post- split or consolidation) was listed at some point as overfished. These situations were highlighted, however, to indicate that they are only partial listings and should not be counted as full stocks. This was the case for Blacktip Shark (SA/GOM), Goliath Grouper (SA/GOM), Yellowtail Snapper (SA/GOM), and Red Drum (SA/ASMFC). How these stocks were counted:
 - i. For consolidated stocks (Goliath Grouper and Yellowtail Snapper), only the final consolidated stock was counted, not the two pre-consolidation stocks. The rationale for this is that the previous history from the two pre-consolidation stocks can be imputed to the single post-consolidation stock, and it is better to work with the current list of stocks that NMFS uses for its SOS reports.
 - ii. For split stocks (Blacktip Shark and Red Drum), only the initial pre-split stock was counted, not the two post-split stocks. The rationale for this is that although it would otherwise be preferable to work with the current list of stocks that NMFS uses for its SOS reports, that is outweighed in these cases by the fact that the overfished listing for both of these stocks happened pre-split and it is unclear which of the post-split stocks to attribute it to. Also, Red Drum was no longer federally-managed after splitting.
7. NO LONGER INCLUDED IN REPORT: Stocks that were listed in the SOS reports for a period of years, then subsequently dropped from the reports, were included so long as they were listed as overfished in one or more of the years that they were included in the report. This was the case for Chinook Salmon (Dungeness River) and Chum Salmon.
8. COMPLEXES IN GENERAL: Some complexes were listed in the early SOS reports as their individual component stocks, then changed later to being listed just as a complex. For these stocks, only the complex was included, not the individual component stocks. (Note that it may have been either the complex or its component stocks that was listed as overfished.) This is the case with Hawaii Bottomfish Complex, Caribbean Grouper Unit 4, Caribbean Grouper Unit 1, and Caribbean Grouper Unit 2 (although these latter two only consist of one species each, so they are not true complexes).
9. COMPLEXES WHERE COMPONENT STOCKS ARE ALSO LISTED: Sometimes the SOS reports will list a complex, and then also have separate listings for several of the component species. In these situations, the complex was included if it (the complex itself) was ever listed as overfished, and the individual stock was also included if it was ever separately listed as overfished. Dusky Shark, Sandbar Shark, and Blacktip Shark were all separately listed as overfished, as was the Large Coastal Shark Complex (the complex to which they belong). Porbeagle and Blacknose Shark, on the other hand, were separately

listed as overfished, but the complexes they belong to (Pelagic Shark Complex and Small Coastal Sharks Complex, respectively) were never listed as overfished.

B. Exclusion of Internationally-Managed Stocks.

1. Because internationally-managed stocks are subject to different requirements under the law, the following stocks were cut: Swordfish (North Atlantic), Blue Marlin (North Atlantic), White Marlin (North Atlantic), Sailfish (Western Atlantic), Bluefin Tuna (Western Atlantic), Bigeye Tuna (Atlantic), Albacore (North Atlantic), Porbeagle (Atlantic), Blacknose Shark (Atlantic), Dusky Shark (Atlantic), Sandbar Shark (Atlantic), Blacktip Shark (Atlantic and Gulf of Mexico), and Large Coastal Shark Complex.

C. Identification of all stocks that have had a post-SFA rebuilding plan (i.e., a rebuilding plan implemented pursuant to Section 304(e) of the Magnuson Act).

1. **ESA-LISTED STOCKS:** Species or Distinct Population Segments listed under the Endangered Species Act are managed primarily through ESA recovery plans, rather than through MSA rebuilding plans. Stocks cut from the study group for this reason were Atlantic Salmon, Chinook Salmon (Columbia Upriver Spring), Chinook Salmon (Columbia Snake Spring/Summer), Chinook Salmon (Columbia North Lewis Fall), Chinook Salmon (Skagit Spring), Chinook Salmon (Skagit Summer/Fall), Chinook Salmon (Stillaguamish Summer/Fall), Chinook Salmon (Cedar Summer/Fall), Chinook Salmon (Snohomish Summer/Fall).
2. **REMOVED FROM FMP:** One stock, Chinook Salmon (Dungeness River), was simply removed from the FMP and no rebuilding plan was made; accordingly, this stock was cut from the study group.
3. **NOT ACTIVELY MANAGED:** A few stocks remain in a FMP, but are not actively managed (and no rebuilding plan made) because fishing is considered a minimal influence on the stock's status. Stocks cut for this reason included Chinook Salmon (Columbia Upriver Summer) and Chum Salmon.
4. **REBUILDING PLAN TO BE DEVELOPED:** Some stocks lack post-SFA rebuilding plans because they are still waiting for the plans to be developed. Stocks cut from the Step 2 spreadsheet for this reason included Chinook Salmon (CA Central Valley Sacramento Fall), Coho Salmon (Washington Coast Queets), and Coho Salmon (Washington Coast Western Juan de Fuca). For these three salmon stocks, "default" rebuilding measures have been used to reduce mortality, as opposed to stock-specific rebuilding plans promulgated in FMP amendments. Both coho salmon stocks are now considered rebuilt.
5. **REBUILDING PLAN MADE BUT ONLY PRE-SFA:** Some stocks had pre-SFA rebuilding plans, but no post-SFA

rebuilding plan was ever made. This could be because the stock fully rebuilt under the pre-SFA plan, or because the stock's status was changed to "unknown" or "undefined" when the SOS report started to use post-SFA status determination criteria. The following stocks were cut from the study group because they only had a pre-SFA rebuilding plan: King Mackerel (Gulf Group), Gag Grouper (SA), Vermilion Snapper (SA), Warsaw Grouper (SA), Speckled Hind (SA), Golden Tilefish (SA), Hancock Seamount Groundfish*, Nassau Grouper (GOM)*, Red Drum (GOM)*, Nassau Grouper (SA)*, Red Drum (SA)*, Goliath Grouper (SA/GOM), Yellowtail Snapper (SA/GOM)**, and Black Grouper (SA)**.

* = treated as a pre-SFA rebuilding plan, but was simply a ban on harvest/possession.

** = unclear whether the stock really had a pre-SFA rebuilding plan.

6. **REBUILDING PLAN NEVER MADE AT ALL:** Some stocks simply never were put into a rebuilding plan, despite being listed as overfished. There were various apparent reasons for this, including: annual stock (SA Pink Shrimp), rebuilding plan submitted but rejected and rebuilding occurred with no plan (Chinook Salmon (Northern CA Klamath Fall)), the overfished designation in the SOS report was uncertain and the stock was subsequently declared not overfished (Pacific Sardine, Pacific Mackerel), the stock was assessed again before a rebuilding plan could be made and found not overfished (Pacific Whiting, Winter Skate), and the status determination criteria and SOS listing changed in an unclear way and a rebuilding plan was never made (Hawaii Bottomfish Complex). All of these stocks were cut from the study group. The fourth quarter 2012 SOS update lists SA Pink Shrimp as not overfished and rebuilt.

D. Identification of stocks for which sufficient information exists to evaluate progress under their rebuilding plans.

1. **POST-SFA REBUILDING PLAN IMPLEMENTED TOO RECENTLY:** If the post-SFA rebuilding plan was implemented too recently to show meaningful results for our evaluative purposes, the stock was removed from the study group. All stocks whose rebuilding plans were implemented in 2010-12 were cut under this rationale. These stocks include Winter Flounder (Georges Bank), Pollock, Windowpane Flounder (Gulf of Maine/Georges Bank), Witch Flounder, Atlantic Wolffish, Smooth Skate, Butterfish, Red Snapper (SA), Red Grouper (SA), Gag Grouper (GOM), and Petrale Sole.
2. **NO ASSESSMENT AFTER REBUILDING PLAN IMPLEMENTED:** Some stocks have had a post-SFA rebuilding plan implemented, but lack a subsequent assessment that can show progress under the rebuilding plan. These stocks were cut from the study group. For stocks remaining in the study group, the most recent stock assessment contained at least one year's worth

of data that post-dates the implementation—not just approval by council—of the rebuilding plan. (Note this is often redundant with the criterion above—that the rebuilding plan cannot have been implemented in 2010 or 2011.) Stocks eliminated from the study group for this reason were Snowy Grouper (SA), Gray Triggerfish (GOM), Vermilion Snapper (GOM), Caribbean Grouper Unit 1, Caribbean Grouper Unit 2, Caribbean Grouper Unit 4, and Queen Conch.

II. SOURCES FOR POPULATION TIME SERIES (IN ORDER OF APPENDIX A TABLE)

Sea Scallops (New England): Northeast Fisheries Science Center. 2010. 50th Northeast Regional Stock Assessment Workshop (50th SAW) Assessment Report, CRD 10-17 (Aug. 2010).

Georges Bank Haddock (New England): Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010, CRD 12-06. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://nefsc.noaa.gov/publications/>.

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Acadian Redfish (New England): Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010, CRD 12-06. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://nefsc.noaa.gov/publications/>.

Southern George Bank/Mid-Atlantic Silver Hake (New England): New England Fishery Management Council. 2012. Final Amendment 19 to the Northeast Multispecies FMP (Small-mesh Multispecies) Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis (Aug. 9 2012).

Southern George Bank/Mid-Atlantic Red Hake (New England): New England Fishery Management Council. 2012. Final Amendment 19 to the Northeast Multispecies FMP (Small-mesh Multispecies) Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis (Aug. 9 2012).

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Monkfish North (New England/Mid-Atlantic): Northeast Fisheries Science Center. 2010. 50th Northeast Regional Stock Assessment Workshop (50th SAW) Assessment Report; New England Fishery Management Council and Mid-Atlantic Fishery Management Council. 2011. Monkfish Fishery Management Plan Framework Adjustment 7 Incorporating Stock Assessment and Fishery Evaluation (SAFE) Report for the 2009 Fishing Year and the Environmental Assessment (May 3, 2011).

Monkfish South (New England/Mid-Atlantic): Northeast Fisheries Science Center. 2010. 50th Northeast Regional Stock Assessment Workshop (50th SAW) Assessment Report.

Spiny Dogfish (New England/Mid-Atlantic): Rago, P. and K. Sosebee. 2011. Update on the Status of Spiny Dogfish in 2011 and Initial Evaluation of Alternative Harvest Strategies (Sept. 11, 2011 peer review draft).

Bluefish (Mid-Atlantic): Coastal/Pelagic Working Group, Northeast Fisheries Science Center and National Marine Fisheries Service. 2012. Bluefish 2012 Stock Assessment Update (July 2012).

Scup (Mid-Atlantic): Terceiro, M. 2012. Stock Assessment of Scup (*Stenotomus chrysops*) for 2012, CRD 12-25 (Oct. 2012)

Mid-Atlantic Black Sea Bass (Mid-Atlantic): Coakley, J., Mid-Atlantic Fishery Management Council. 2011. Memorandum to C. Moore re Black Sea Bass Management Measures for 2012 (June 27, 2011); Shepherd G.R., Nieland J. 2010. Black Sea Bass 2010 stock assessment update, CRD 10-13. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://www.nefsc.noaa.gov/nefsc/publications/>.

Summer Flounder (Mid-Atlantic): Terceiro, M. 2012. Stock assessment of summer flounder for 2012, CRD 12-21. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://www.nefsc.noaa.gov/nefsc/publications/>.

Mid-Atlantic Golden Tilefish (Mid-Atlantic): Northeast Fisheries Science Center. 2009. 48th Northeast Regional Stock Assessment Workshop (48th SAW) Assessment Report (including Appendix A3: Model Output), CRD 09-10. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://www.nefsc.noaa.gov/nefsc/publications/>.

Gulf of Mexico Red Grouper (Gulf of Mexico): 2009. Stock Assessment of Red Grouper in the Gulf of Mexico—SEDAR Update Assessment—Report of Assessment Workshop, Miami, Florida, March 30-April 2, 2009.

Lingcod (Pacific): Hamel, O.S., S.A. Sethi and T.F. Wadsworth. 2009. Status and Future Prospects for Lingcod in Waters off Washington, Oregon, and California as Assessed in 2009.

Widow Rockfish (Pacific): He, X., D.E. Pearson, E.J. Dick, J.C. Field, S. Ralston, and A.D. MacCall. 2011. Status of the widow rockfish resource in 2011.

St. Matthew Island Blue King Crab (North Pacific): The Plan Team for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands. 2011. Stock Assessment and Fishery Evaluation Report for the King And Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions, 2011 Crab SAFE.

Bering Sea Snow Crab (North Pacific): The Plan Team for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands. 2011. Stock Assessment and Fishery Evaluation Report for the King And Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions, 2011 Crab SAFE.

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American Plaice (New England): Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010, CRD 12-06. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://nefsc.noaa.gov/publications/>.

Barndoor Skate (New England): Northeast Data Poor Stocks Working Group. 2009. The Northeast Data Poor Stocks Working Group Report, December 8-12, 2008 Meeting. Part A. Skate species complex, deep sea red crab, Atlantic wolffish, scup, and black sea bass, (CRD 09-02). Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://www.nefsc.noaa.gov/nefsc/publications/>; New England Fishery Management Council. 2012. 2012-2013 Northeast Skate Complex Specifications Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis (Mar. 7, 2012).

Darkblotched Rockfish (Pacific): Stephens, A., O. Hamel, I. Taylor, and C. Wetzel. 2011. Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California in 2011 (Nov. 2011).

Pacific Ocean Perch (Pacific): Hamel, O.S. and K. Ono. 2011. Stock Assessment of Pacific Ocean Perch in Waters off of the U.S. West Coast in 2011 (Sept. 20, 2011).

Southern Pacific Coast Bocaccio (Pacific): Field, J.C. 2011. Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey and Eureka INPFC areas as evaluated for 2011.

Canary Rockfish (Pacific): Wallace, J.R. and J.M. Cope. 2011. Status update of the U.S. canary rockfish resource in 2011 (final corrected version).

Yelloweye Rockfish (Pacific): Taylor, I.G. and C. Wetzel. 2011. Status of the U.S. yelloweye rockfish resource in 2011 (Update of 2009 assessment model) (Sept. 9, 2011).

Cape Cod/Gulf of Maine Yellowtail Flounder (New England): Northeast Fisheries Science Center. 2012. Assessment or Data Updates of 13 Northeast Groundfish Stocks through 2010, CRD 12-06. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://nefsc.noaa.gov/publications/>.

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Gulf of Mexico Red Snapper (Gulf of Mexico): 2009. Stock Assessment of Red Snapper in the Gulf of Mexico—SEDAR Update Assessment—Report of the Update Assessment Workshop, Miami, Florida, August 24-28, 2009; Linton, B. 2011. Personal communication (May 2011).

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Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at <http://www.nefsc.noaa.gov/nefsc/publications/>.

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Thorny Skate (New England): New England Fishery Management Council. 2011. Framework Adjustment 1 to the Fishery Management Plan for the Northeast Skate Complex Including an Environmental Assessment and an Initial Regulatory Flexibility Analysis.

Gulf of Mexico Greater Amberjack (Gulf of Mexico): Southeast Data, Assessment, and Review. 2011. SEDAR 9 Stock Assessment Update Report, Gulf of Mexico Greater Amberjack.

Pribilof Islands Blue King Crab (North Pacific): The Plan Team for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands. 2011. Stock Assessment and Fishery Evaluation Report for the King and Tanner Crab Fisheries of the Bering Sea and Aleutian Islands Regions, 2011 Crab SAFE (Sept. 2011).

III. CALCULATING GROSS COMMERCIAL REVENUES FOR 28 “SUCCESS STORIES” STOCKS

- A. Commercial landings data were compiled from the most recent assessment for each stock. Other sources were used to fill in the most recent years, if necessary, including preliminary landings statistics and documents available from regional fishery management councils.
- B. Commercial landings and revenues were compiled from the NMFS fisheries landings website, http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html.
- C. Commercial revenue estimates were then made for each stock by dividing the website revenue value for each year by the corresponding website landings value for that year, producing a time series of \$/ton values for each stock. The \$/ton value for each year was then multiplied by the stock assessment landings time series, in order to get an estimated revenues time series for the stock.
- D. This approach was taken because the NMFS website does not compile information on a stock unit basis. Conversely, while stock assessments do contain landings information on a stock unit basis, they do not generally include revenues information. The time series from the website was compiled for the geographic units most closely corresponding to that of the stock unit (i.e., the time series for all Atlantic states was compiled to correspond to the stock Atlantic sea scallops); this assumed that \$/ton value of a stock did not vary significantly based on minor geographic variations. If the time series from the website was incomplete, such as containing a data gap for a number of years or in case of obvious error, the average of years on each side of the data gap was used to fill the gap.

Endnotes

- 1 A stock is a management unit of a fish population; for example, the U.S. Atlantic cod population is divided into the Georges Bank cod stock and the Gulf of Maine cod stock.
- 2 142 Cong. Rec. 10794 (daily ed. Sept. 18, 1996) (statement of Sen. Kerry). Aggregate lost commercial catch as a result of overfished stocks in the New England, South Atlantic, and Gulf regions in 2009 was valued at almost \$165 million, with most of the catch loss (\$149 million) attributable to New England. Ecotrust, *The Hidden Cost of Overfishing to Commercial Fishermen: A 2009 Snapshot of Lost Revenues, Report to The Pew Charitable Trusts* (July 25, 2011). The net present value of gross (ex-vessel) commercial revenues and recreational revenues from rebuilding 17 overfished U.S. stocks from different regions was estimated to be \$567 million compared to \$194 million for a “recent catch” scenario. Ussif Rashid Sumaila et al., *Economic benefits of rebuilding U.S. ocean fish populations*, The University of British Columbia Fisheries Centre working paper (2006).
- 3 Jeffrey A. Hutchings et al., “Marine Fish Population Collapses: Consequences for Recovery and Extinction Risk,” *BioScience* (April 2004): 297-309; Jeffrey A. Hutchings, “Collapse and recovery of marine fishes,” *Nature* (Aug. 24 2000): 882-885.
- 4 Additional information on this study can be found at <http://www8.nationalacademies.org/cp/projectview.aspx?key=49433>.
- 5 Andrew A. Rosenberg et al., “Rebuilding U.S. Fisheries: Progress and Problems,” *Frontiers in Ecology and the Environment* (Aug. 2006): 303-308; see also J.H. Swasey et al., “An Evaluation of Rebuilding Plans for U.S. Fisheries,” MRAG Americas, Inc., for Lenfest Ocean Program (April 2006). NMFS also annually conducts a Trend Analysis for Fish Stocks in Rebuilding Plans; the most recent analysis is available at www.nmfs.noaa.gov/sfa/statusoffisheries/2011/RTC/2011_RTC_TrendAnalysis.pdf.
- 6 Any stock assessment released subsequent to our data compilation may provide a representation of the stock’s health—either better or worse—that is different from what is provided by the stock assessments relied on for this report. This may be the result of improved or updated information relating to changes in management, environmental conditions, the understanding of stock dynamics, or other factors. A number of stocks we examined have assessments that are several years old. For example, the last full assessment for Gulf of Mexico red snapper was completed in 2005 with an update in 2009. A new assessment is currently underway, and there are some indications that the condition of the stock has improved. Other assessments, while recent, are considered highly uncertain. The assessments for black sea bass and tilefish in the Mid-Atlantic are two such examples.
- 7 If more than one model or model run was provided by the assessment, we used the outputs from the specific model or model run identified as preferred in the assessment and peer review report, and by council science and statistical committees.
- 8 The six stocks are Nassau grouper (South Atlantic), speckled hind (South Atlantic), Warsaw grouper (South Atlantic), goliath grouper (South Atlantic/Gulf of Mexico), red drum (Gulf of Mexico), and Nassau grouper (Gulf of Mexico).
- 9 NMFS’s 2011 SOS report states that 27 stocks have been rebuilt; these stocks were specifically identified in a spreadsheet provided to NRDC. There are several reasons for the discrepancies with our list: 8 of the stocks identified by NMFS were never actually overfished and/or never received a post-SFA rebuilding plan, 2 are subject to international agreements, 1 was allowed to become overfished after it was initially rebuilt, and 1 is approaching an overfished condition. In addition, our list includes several stocks that were not declared rebuilt until after the release of the 2011 SOS report (and thus were not considered as rebuilt in that report).
- 10 Nineteen of the twenty-one stocks have been designated rebuilt. Tilefish and red hake have achieved their rebuilding targets but have not formally been designated as rebuilt. As noted in the methodology, this report generally treats all twenty-one stocks as rebuilt.
- 11 The connection between failure to rebuild and overfishing was previously described in Andrew A. Rosenberg et al., “Rebuilding US fisheries: Progress and Problems,” *Frontiers in Ecology and the Environment* (Aug. 2006): 303-308.
- 12 National Marine Fisheries Service, 4th Quarter Update Table A. Summary of Stock Status for FSSI Stocks, available at http://www.nmfs.noaa.gov/sfa/statusoffisheries/2012/fourth/Q4_2012_FSSI_nonFSSIstockstatus.pdf.
- 13 See, e.g., John Wiedenmann and Marc Mangel, *A Review of Rebuilding Plans for Overfished Stocks in the United States: Identifying Situations of Special Concern*, Lenfest Ocean Program (2006); Jeffery A. Hutchings et al., “Marine Fish Population Collapses: Consequences for Recovery and Extinction Risk,” *BioScience* (April 2004): 297; Steven A. Murawski, “Rebuilding depleted fish stocks: the good, the bad, and, mostly, the ugly,” *ICES Journal of Marine Science* (2010): 1830-1840; available at <http://icesjms.oxfordjournals.org/content/67/9/1830.full.pdf+html?sid=d3627201-fc68-4ac5-b9cd-26272468d54d>; Jeffery A. Hutchings, “Influence of population decline, fishing, and spawned variability on the recovery of marine fishes,” *Journal of Fish Biology* (December 2001): Issue Supplement A: 306-322.
- 14 None of these figures include Gulf of Maine haddock, which was recently identified as approaching an overfished condition after having been designated as rebuilt.
- 15 The MSA creates eight regional fishery management councils, each responsible for stocks within its region. See 16 U.S.C. § 1852(b).
- 16 In the Western Pacific, one fishery is designated as overfished and is now closed (a rebuilding plan was never formally developed).
- 17 A recent study found that the median population level for unassessed stocks in developed countries was $B/B_{msy}=0.56$, which is a level of depletion that is very close to what is frequently set as the overfished threshold for assessed stocks in the U.S. ($B/B_{msy}=0.50$). Christopher Costello et al., “Status and Solutions for the World’s Unassessed Fisheries,” *Science* (October 2012): 517-520.
- 18 Both stocks are listed as subject to overfishing.
- 19 Rebuilding plan start dates are provided in Table 1; if Table 1 provides two start dates for rebuilding plan, the first one is used in these figures.
- 20 The federal courts have played a role in both the Mid-Atlantic and Pacific regions in keeping rebuilding on track. See *NRDC v. Daley*, 209 F.3d 747 (D.C. Cir. 2000) (court struck down a summer flounder quota with only an 18% probability of not exceeding the overfishing and rebuilding level); *NRDC v. NMFS*, 421 F.3d 872 (9th Cir. 2005) (court struck down increase in catch limit for darkblotched rockfish following an assessment that showed the stock to be in worse shape than originally projected).
- 21 Marlene Bellman et al., “Estimated discard and catch of groundfish species in the 2011 U.S. west coast fisheries,” West Coast Groundfish Observer Program, National Marine Fisheries Service (Oct. 2012): 25-58.
- 22 The New England council co-manages monkfish with the Mid-Atlantic council, with the New England council taking the lead in decision making.
- 23 One of these stocks, the southern monkfish stock, responded positively to a rebuilding plan implemented in 1999. The assessment methods for this stock, which remain uncertain, have changed significantly over time. As indicated in Figure 6C, these changes indicate that the stock was never overfished and has consistently been above the rebuilding target as it has been revised.
- 24 Boris Worm et al., “Rebuilding Global Fisheries,” *Science* (July 31, 2009): 578-585; U.S. Commission on Ocean Policy, *An Ocean Blueprint for the 21st Century*. Final Report (2004); Pew Oceans Commission, *America’s Living Oceans – Charting a Course For Sea Change* (May 2003).
- 25 Jeffrey A. Hutchings et al., “Marine Fish Population Collapses: Consequences for Recovery and Extinction Risk,” *BioScience* (April 2004): 297-309; Jeffrey A. Hutchings, “Collapse and Recovery of Marine Fishes,” *Nature* (Aug. 24, 2000): 882-885.

- 26 Additional detail on how we conducted this analysis is provided in Appendix B.
- 27 This is likely an underestimate of revenue growth as a result of rebuilding because for some key species, such as scallops, initial rebuilding measures were adopted prior to implementation of the formal rebuilding plan.
- 28 http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html (sea scallops); <http://www.nefsc.noaa.gov/publications/crd/crd1230/> (groundfish).
- 29 Overall gross commercial revenues from landings of all species in each region were compiled from http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html; the revenues were adjusted using the Consumer Price Index.
- 30 U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), "Annual NOAA report shows record number of rebuilt fisheries," (May 14, 2012), http://www.noaaneews.noaa.gov/stories2012/20120514_statusofstocks.html.
- 31 U.S. Department of Commerce, NOAA, "Recreational Fishing - An American Pastime," NOAA's State of the Coast, http://stateofthecoast.noaa.gov/rec_fishing/welcome.html (accessed January 7, 2013).
- 32 Scup and summer flounder angler trip and catch information compiled from U.S. Department of Commerce, NOAA, *Marine Recreational Fisheries Statistics Survey*, available at <http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/index>; Mark Terceiro, "Stock Assessment for Summer Flounder for 2011," NOAA NEFSC, Reference Document 11-20 (Oct. 2011); Mark Terceiro, "Stock Assessment for Scup for 2011," NOAA NEFSC, Reference Document 11-201 (Oct. 2011).
- 33 Brad Gentner and Scott Steinback, "Marine Angler Expenditures in the United States, 2006," NOAA Technical Memorandum NMFS-F/SPO-94 (Nov. 2008; revised Dec. 2008).
- 34 Ecotrust, *Economic Costs of Historic Overfishing on Recreational Fisheries: South Atlantic & Gulf of Mexico Regions, Report to The Pew Charitable Trusts*, July 26, 2012.
- 35 NOAA Fisheries Service, *Fish Stock Sustainability Index (FSSI), 2012 Quarter 4 Update through December 31, 2012*, available at <http://www.nmfs.noaa.gov/sfa/statusoffisheries/2012/fourth/Q4%202012%20FSSI%20Summary%20Changes.pdf>.
- 36 *Id.*
- 37 The World Bank and The Food and Agriculture Organization of the United Nations, *The Sunken Billions—The Economic Justification for Fisheries Reform*, 2008.
- 38 Boris Worm et al., "Rebuilding Global Fisheries," *Science* (July 31, 2009):578-585 (examining stocks from U.S., Canada, Australia, New Zealand, Argentina, and South Africa, plus a number of international fisheries). Other studies that provide estimates of the level of depletion of assessed and unassessed stocks globally include: Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2012*, 2012: 53, <http://www.fao.org/docrep/016/i2727e/i2727e.pdf> (estimating the number of overexploited stocks ($B < B_{msy}$) globally to be 30%); and Daniel Pauly, "The Sea Around Us Project. Documenting and Communicating Global Fisheries Impacts on Marine Ecosystems," *AMBIO: a Journal of the Human Environment* (June 2007):290-95 (finding 52% of stocks to be depleted).
- 39 European Commission, *Communication from the Commission to the Council concerning a consultation on Fishing Opportunities for 2013*, Brussels, 7.6.2012 COM (2012) 278 final: 12 (re stock status in 2012, 44% of stocks in "Northeast Atlantic and adjacent waters" outside "safe biological limits"). The FAO estimates that 31% of Northeast Atlantic stocks and 50% of Mediterranean and Black Sea stocks are below B_{msy} . Food and Agriculture Organization of the United Nations, *The State of World Fisheries and Aquaculture 2012*, 2012: 58-59, <http://www.fao.org/docrep/016/i2727e/i2727e.pdf> (31% and 50% estimates for 2011).
- 40 California Environmental Associates, *Charting a Course to Sustainable Fisheries*, July 18, 2012: 14-15.
- 41 Commission of the European Communities (European Commission), *Communication from the Commission to the European Parliament and to the Council on promoting the adaptation of the European Union fishing fleets to the economic consequences of high fuel prices*, Brussels, 8.7.2008 COM (2008) 453, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0453:FIN:EN:PDF>. One study estimated that reduced EU landings of 43 fish stocks resulted in almost \$3.2 billion in lost revenue and approximately 100,000 fewer jobs. See The New Economics Foundation (NEF), *Jobs lost at sea—overfishing and the jobs that never were* February 10, 2012, <http://www.neweconomics.org/node/1968>.
- 42 NMFS, *Fisheries of the United States—2011* August 2012, www.st.nmfs.noaa.gov/commercial-fisheries/fus/fus11/index.



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