



# American Aquaculture

An Overview of the Current Status, Environmental Impacts, and Legislative Opportunities

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By Alexandra Carter and Miriam Goldstein May 2019

Center for American Progress



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# Introduction and summary

The ocean is the final frontier of food. In much of the world, the only wild food that people consume is seafood. However, seafood is farmed as well as wild caught, and the aquaculture sector is growing faster than many other major food production sectors.<sup>1</sup> Domestic marine aquaculture has increased in volume and value since 2009.<sup>2</sup>

Aquaculture is a broad term used to refer to any farmed aquatic species, from freshwater trout to saltwater shellfish.<sup>3</sup> Although freshwater aquaculture and onshore saltwater aquaculture are both important and growing U.S. economic sectors, this report deals solely with saltwater farms that are placed in existing natural systems offshore.

Many advocates for aquaculture see the sector as an opportunity to supply the nation with another source for resource-efficient<sup>4</sup> protein without putting additional stress on wild stocks.<sup>5</sup> In the United States, where shellfish aquaculture in state-managed waters is thriving, the current policy debate centers around if and how aquaculture should be expanded to federal waters. Furthermore, the United States could become an attractive investment opportunity for developers interested in establishing new offshore industries.<sup>6</sup> Other stakeholders remain concerned about the significant environmental challenges that are associated with the specific type and location that each aquaculture project presents.<sup>7</sup>

Ocean aquaculture can be divided into two major sectors: fed and unfed. Fed aquaculture projects include finfish such as salmon and kampachi. These fish produce waste byproducts and require feed, which often—though not always—contains wild-caught fish. Unfed systems include seaweed and shellfish such as mussels and oysters. Seaweed requires only sunlight, and mussels and oysters feed off microscopic plankton that naturally occurs in seawater, sustaining themselves without additional inputs.

Currently, state waters successfully support unfed aquaculture systems, including oysters, mussels, and clams. Large fed aquaculture industries in the Pacific Northwest and New England have proved more controversial. With aquaculture poised for expansion into federal waters, policymakers must carefully consider site selection, best practices for the industry, and the differences between unfed aquaculture systems and industrial fed finfish systems.

This report provides an overview of the current status of aquaculture in the United States before detailing different types of aquaculture and discussing opportunities and challenges in the sector. Finally, the report outlines some of the legislative options available if the United States wants to implement sustainable, progressive aquaculture practices.

# Legal status of offshore aquaculture in the United States

There is an absence of clarity on federal aquaculture regulations, and development is functionally very difficult because of the present regulatory structure. Initially, the National Aquaculture Act of 1980,<sup>8</sup> signed into law by former President Jimmy Carter, created an interagency coordinating body known now as the Subcommittee on Aquaculture.<sup>9</sup> The subcommittee, which is housed in the National Science and Technology Council<sup>10</sup> and reports to the Executive Office of the President, is currently tasked with documenting federal opportunities for aquaculture and developing a plan for interagency coordination on “regulatory streamlining.”<sup>11</sup> There are currently at least six federal agencies that collectively regulate different aspects of the U.S. aquaculture industry:<sup>12</sup> the Food and Drug Administration; the National Oceanic and Atmospheric Administration (NOAA); the U.S. Army Corps of Engineers; the U.S. Department of Agriculture; the U.S. Environmental Protection Agency; and the U.S. Fish and Wildlife Service. For aquaculture proponents, this has proved burdensome and unpredictable.<sup>13</sup> When surveyed, aquaculture businesses named regulatory issues as a key barrier to growth within the industry. To the authors’ knowledge, the current state of aquaculture in federal waters is one business that completed two short-term offshore finfish tests in Hawaii,<sup>14</sup> one pilot mussel farm project in Massachusetts,<sup>15</sup> and one mussel farm in California.<sup>16</sup>

NOAA’s National Marine Fisheries Service (NMFS) attempted to clarify this regulatory thicket in 2016. Acting through the regional council process of creating a fishery management plan for farmed fishes, the NMFS issued the final rule to implement the Fishery Management Plan for Regulating Offshore Aquaculture in the Gulf of Mexico.<sup>17</sup> This rule was based on a general counsel’s interpretation that the inclusion of the term “harvesting” in the definition of the term “fishing” within the Magnuson-Stevens Fishery Conservation and Management Act (MSA)—the primary federal law governing U.S. fisheries management—applied to harvesting farmed fish as well as wild fish. It would have created a NMFS-run regulatory program for managing aquaculture in the federal waters of the Gulf of Mexico. However, a coalition of fishing and public interest groups challenged the rule in court on the grounds that the MSA only allows the NMFS to manage fishing and that aquaculture did not fit the definition of “fishing.”<sup>18</sup>

On September 25, 2018, the U.S. District Court of Louisiana issued an opinion denying the NMFS' final rule and halting implementation of the management plan for the Gulf of Mexico. The judge wrote: "It is often said that 'Congress does not hide elephants in mouseholes,' and this Court cannot imagine a more fitting example. Had Congress intended to give the NMFS the authority to create an entirely new regulatory permitting scheme for aquaculture operations, it would have said more than 'harvesting.'"<sup>19</sup> The court's decision stopped the NMFS from permitting aquaculture under the MSA, leaving congressional action as one of the only options for improving the aquaculture development process in U.S. federal waters. Rep. Don Young (R-AK) has highlighted this point repeatedly in Congress. On May 1, 2019, Rep. Young reintroduced H.R. 2467, a bill that would prohibit federal agencies from permitting finfish aquaculture in federal waters unless and until Congress passes a future law authorizing such permits.<sup>20</sup>

While there has been congressional interest in regulating offshore aquaculture for at least a decade, it can best be characterized as intermittent. After the National Aquaculture Act of 1980 was enacted, the saltwater aquaculture industry expressed concerns about specific issues associated with that type of aquaculture, including user conflicts, environmental impacts, and affordable establishment of operations.<sup>21</sup> Former Rep. Gerry Studds (D-MA) responded to these concerns by introducing the Marine Aquaculture Enhancement Act of 1994, which would have created a regulatory framework to govern aquaculture in federal waters.<sup>22</sup> The bill was never passed out of committee. In the 111th Congress, former Rep. Lois Capps (D-CA) introduced the National Sustainable Offshore Aquaculture Act of 2009, which tried again to establish a regulatory framework for offshore aquaculture in America<sup>23</sup> and was supported by a variety of stakeholders, including several environmental non-governmental organizations<sup>24</sup> and trade organizations.<sup>25</sup> The Deepwater Horizon oil spill occurred later the same Congress, however, leading to a competing bill from former Sen. David Vitter (R-LA), titled the Research in Aquaculture Opportunity and Responsibility Act of 2010.<sup>26</sup> This bill would have suspended all aquaculture in the Gulf of Mexico for three years, which Sen. Vitter explained was in response to the difficulties that the oil spill posed to the Gulf's ecosystems.<sup>27</sup> Neither bill made it to a full chamber discussion or vote before the end of the 111th Congress.

In the 115th Congress, Sen. Wicker (R-MS) introduced the Advancing the Quality and Understanding of American Aquaculture (AQUAA) Act,<sup>28</sup> which proposed sweeping changes to various regulatory processes that apply to aquaculture. Rep. Steven M. Palazzo (R-MS) and Rep. Collin C. Peterson (D-MN) introduced a

House companion bill, H.R. 6966.<sup>29</sup> The AQUAA Act was aimed at fostering relatively fast industry development in federally managed American waters and found strong support among industry groups such as Stronger America Through Seafood, an aquaculture trade group supported by more than a dozen seafood producers, processors, and large corporations.<sup>30</sup> The bill was not voted on by the full U.S. Senate or House in the 115<sup>th</sup> session and has not yet been reintroduced this Congress.

## The AQUAA Act

The AQUAA Act facilitated ease of permitting through the creation of the Office of Marine Aquaculture at the cost of environmental safeguards. Environmental groups,<sup>31</sup> fishermen,<sup>32</sup> and many congressional Democrats opposed the bill. Three of the main issues in the bill included:

- 1. Expedited permitting timelines and extended permit durations for new aquaculture projects.** The AQUAA Act only allowed 30 days for permits to be evaluated and decided on. Once issued, the permits were valid for 25 years, with the option to reapply for an additional 25-year permit upon expiration; some stakeholders also found the long permit duration concerning. The short permit evaluation timelines would not have given regulators adequate time to evaluate a project; would have left little or no time for evaluation of public comment; and then could have hampered the agency's ability to make informed decisions. Long-term decisions on new developments in environmentally sensitive areas should not be made on expedited timelines without public comment.
- 2. Lack of information on Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) enforcement.** The AQUAA Act did not specify how the MMPA and the ESA would interact with its proposed Office of Marine Aquaculture. Although new aquaculture developments would be expected to encounter marine mammals and endangered species, it was unclear whether or not the bill would give the Office of Marine Aquaculture authority over the application of these laws within the context of offshore aquaculture permitting. This is of particular concern for the critically endangered right whale, which is prone to entanglement in certain types of fixed line gear that are similar to gear used in aquaculture.<sup>33</sup>
- 3. Inadequately addressed potential effects on wild stocks.** The AQUAA Act lacked controls on what types of feed that fed aquaculture systems can use. This poses a threat to wild forage fishes—small pelagic fishes such as menhaden, sardines, and anchovies—that are used to make animal feed. Forage fish support diverse oceanic food webs and have experienced population collapses in recent years, and expanding aquaculture development without feed controls could further jeopardize these vital species.<sup>34</sup> While domestic fisheries are well regulated under the MSA, increasing demand for internationally harvested forage fish without traceability requirements or other controls could negatively affect the very wild fisheries that aquaculture proports to save. NOAA maintains the Seafood Import Monitoring Program, which establishes reporting and recordkeeping requirements for imports of certain seafood products, but forage fish—commonly used in fishmeal and fish oil—are not included in the program.<sup>35</sup>

Now, in the 116th Congress, aquaculture remains a top priority for Sen. Wicker, who is currently the chairman of the U.S. Senate Committee on Commerce, Science, and Transportation. The issues for congressional members to consider are likely to remain the same: First, should the United States facilitate aquaculture permitting and development in federal waters? If so, what types? And second, what safeguards are necessary for sustainable and environmentally responsible aquaculture?

# Aquaculture explained

Due to the complex nature of permitting offshore aquaculture, policymakers should consider its many possible effects on the environment and the economy before legislating a new national permitting process. Studies have shown that there are benefits and risks associated with aquaculture, all of which should be taken into account when creating a sustainable progressive plan if aquaculture is to be expanded in America.

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## Advantages of aquaculture

In 2016, American marine aquaculture production was valued at more than \$400 million.<sup>36</sup> While this is small compared with other types of livestock farming (for example, the U.S. poultry industry is valued at \$48.3 billion<sup>37</sup>), coastal communities have realized significant social and economic benefits. In Maine, for instance, aquaculture supports more than 100 aquaculture businesses and more than 1,000 jobs, and 73 percent of aquaculture businesses interviewed by the University of Maine Aquaculture Research Institute expect sales to increase in future years.<sup>38</sup>

Because aquaculture systems make efficient use of input nutrients and protein, they can be a sustainable source of animal protein for human consumption.<sup>39</sup> Aquaculture systems, on average, have more efficient feed conversion ratios than traditional land-based livestock, meaning that it takes less input protein, or feed, to produce harvestable farmed fish such as salmon than it does to produce farmed beef, pork, or chicken.<sup>40</sup> Aquaculture also uses less freshwater and land while producing fewer greenhouse gasses than traditional land-based livestock systems.<sup>41</sup> In addition to its sustainability potential, seafood is a healthy protein choice containing vitamins, nutrients, and polyunsaturated fatty acids, which are not always present in traditional land-based proteins and play a significant role in human health.<sup>42</sup> If implemented correctly, aquaculture systems could play a significant role in national and global sustainable food production.

Unfed aquaculture can provide ecosystem benefits. Global unfed aquaculture—essentially shellfish and seaweed—provide nonfood services that have been estimated to produce \$6.47 billion annually, including removing carbon from the atmosphere, cleaning the water, and creating marine habitat.<sup>43</sup> Oysters are particularly efficient at removing carbon from the surrounding water, with one square kilometer of oysters able to sequester nearly 960 metric tons of carbon per year.<sup>44</sup> This is more efficient than salt marshes, mangroves, and seagrasses combined<sup>45</sup> and is the equivalent of taking more than 200 cars off the road.<sup>46</sup> Oysters, mussels, and clams also clean the water by eating huge quantities of microscopic plankton, which removes excess nutrients from the water and increases its clarity, benefitting seagrasses and other marine life.<sup>47</sup> Oysters and mussels form reefs, creating a habitat that fosters greater ecological diversity<sup>48</sup> and increases wild stocks of commercially and recreationally valuable fish.<sup>49</sup>

## Catalina Sea Ranch

The majority of shellfish aquaculture in America is currently located in state waters, but one commercial development has already started in the federal waters off southern California: Catalina Sea Ranch. The small business now consists of 100 acres and hopes to expand to 3,000 acres in the near future.<sup>50</sup>

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## Disadvantages of aquaculture

Like all farming systems, aquaculture is designed to maximize the food grown in the available space. Unlike land systems, aquaculture typically requires nets or lines to anchor the farm in place. These core aspects of aquaculture risk the following interactions: entanglements,<sup>51</sup> escapement,<sup>52</sup> and the introduction of pathogens.<sup>53</sup>

Entanglements<sup>54</sup>—which most often affect marine mammals—can happen with fixed gear, as used for mussels and seaweed as well as any loose hanging lines or slack nets, and are often fatal. Globally, it is estimated that entanglement in fishing gear already kills 300,000 whales and dolphins annually,<sup>55</sup> and an increase in aquaculture gear could pose additional risks to wild species. In recent years, Canadian regulatory efforts to reduce entanglement fatalities at aquaculture facilities have proved effective.<sup>56</sup> In 2017, entanglement fatalities in the British Columbia region were just 0.13 percent of what they were in 1999. This was achieved through improved antipredator netting and reducing the presence of attractants such as excess fish feed.

Escapement<sup>57</sup> is the term used for any amount of live aquaculture stock escaping its enclosure or containment method, which can result in nonnative species being introduced to new bodies of water or the aquaculture stock interbreeding with wild populations. The most infamous case occurred in Washington state in 2017, when more than a quarter million Atlantic salmon escaped, or “spilled,” into the Pacific ocean. (see sidebar) Norway’s implementation of the Norwegian technical standard,<sup>58</sup> which details specific regulations governing fish enclosures, reduced total escapements by more than 66 percent despite a 44 percent growth in the total number of fish over eight years.<sup>59</sup> However, this success story also illustrates the need for species-specific regulation and research. During this same time, under the same regulation, Norwegian cod escapements did not decrease significantly.

### Case study:

#### Escapement from a Cooke Aquaculture facility in Washington state

Cooke Aquaculture in Washington state sustained substantial net damage from poor maintenance practices. The resulting damage allowed for 263,000 nonnative Atlantic salmon to spill into the Puget Sound and Pacific Ocean in 2017. In April of 2019, Cooke dropped its appeal and agreed to pay Washington \$332,000 in fines.<sup>60</sup> This incident has inspired caution on the state’s part; in 2018, Washington Gov. Jay Inslee (D) signed a bill phasing out nonnative finfish aquaculture practices in Washington waters.<sup>61</sup> Despite these actions, however, Cooke has continued to expand, buying out aquaculture, distribution, fishmeal production, and wild fishery businesses throughout the world. Cooke Aquaculture currently farms salmon in the United States, the United Kingdom, Chile, and Spain and has bought at least four seafood businesses in 2019.<sup>62</sup>

Pathogens are more likely to cause disease outbreaks when live animals and plants are kept in higher-than-natural densities.<sup>63</sup> This risks the health of both aquaculture stock and wild populations. For example, many sea lice species commonly found on salmon can be transferred between farmed and wild salmon<sup>64</sup> and can cause significant—more than 25 percent—mortality in affected populations.<sup>65</sup> Additionally, animal transport within the aquaculture industry leads to the introduction of exotic pathogens in wild ecosystems, which some researchers consider a top concern.<sup>66</sup>

One suggested remedy to this concern is siting farms in appropriate areas, away from migrating wild populations, and appropriate distances from other farms.<sup>67</sup> Additionally, proper aquaculture development siting could enable managers to take

advantage of favorable currents for regular flushing of the aquaculture system and variation of water temperature to inhibit disease growth. Veterinary drug use should be minimized to prevent antibiotic resistance in aquaculture systems.<sup>68</sup>

Fed aquaculture systems have additional risks, which should not be taken lightly. Aquaculture operations that grow predatory fish such as salmon or tuna must feed the fish with a certain quantity of protein, often wild-caught fish. Specifically, fed aquaculture systems' waste discharges have had negative effects on local wildlife and habitats.<sup>69</sup> In regions of high aquaculture output such as New Brunswick, Canada, salmon aquaculture is the largest anthropogenic source of organic input to the coastal zone, which can fuel more frequent and more intense harmful algal blooms, deplete ambient oxygen, and alter the food chain.<sup>70</sup>

# Policy recommendations

Given global trends, aquaculture is likely to only grow more central to the global food supply. The policy question at hand is what role the United States should play amid the expansion of aquaculture. While U.S. shellfish aquaculture has provided significant economic benefits for otherwise struggling coastal communities at relatively little environmental cost, it is unlikely that the U.S. offshore aquaculture would be able to compete economically with the massive infrastructure investments being made by Norway and China.<sup>71</sup> However, that is no reason to avoid implementing robust safeguards to avoid undesirable environmental consequences, including effects on wild stocks, water pollution, and habitat destruction.<sup>72</sup>

Examples of such guidelines—which could inform future policy—already exist. The Monterey Bay Aquarium’s Seafood Watch program defines sustainable aquaculture as programs that:

- Require robust and timely production data
- Do not allow discharge of wastes over certain environmentally determined levels
- Specify appropriate siting locations<sup>73</sup>

Other organizations provide voluntary certification. For example, the Global Aquaculture Alliance’s Best Aquaculture Practices standards—including finfish and crustacean and salmon—set out a broad range of environmental and social standards. These standards have been recognized by several industry benchmarking efforts, including the Global Food Safety Initiative, Global Social Compliance Programme, and Global Sustainable Seafood Initiative.<sup>74</sup>

The U.S. environment and existing aquaculture structure is suitable for a two-tiered permitting system for aquaculture in federal waters. Both fed and unfed aquaculture should adhere to a series of robust environmental standards to minimize effects on surrounding ecosystems and fisheries. Fed aquaculture developments should have to complete an additional series of precautionary measures to address the additional risks associated with the system.

A federal permitting program for all types of aquaculture should include the following components:

- **A plan.** Any plan should include a clear outline of what each federal agency will do to support aquaculture regulation, with a specific role for each agency. While NOAA certainly has significant expertise in managing fish and other marine life, other agencies may have more expertise in other aspects of aquaculture such as construction or siting. Proper application and implementation of all relevant laws will require significant coordination.
- **Full compliance with the National Environmental Policy Act.** Every aquaculture permit should complete a full environmental impact statement with a robust public review process. Timelines for this review should not be unduly abridged, and the government should use the tools at its disposal to expedite permitting.<sup>75</sup>
- **Marine mammal and protected or endangered species considerations.** Given the high likelihood of marine mammal and protected or endangered species interactions with aquaculture facilities, a proposed federal program should have a siting plan to minimize interactions; an enforcement plan to require gear modifications such as limited rope strength; and a plan to make industry-wide changes to prevent interactions if necessary.
- **Siting plan.** Offshore aquaculture is inextricably tied to the wild ocean environment. Taking advantage of currents, nutrient flow, and geological features in the siting of each permit could help avoid and mitigate many of the risks that are associated with aquaculture, while capitalizing on some of the benefits.<sup>76</sup> A siting plan should be included that would consider environmental conditions, biological interactions, and interactions with other ocean uses. Each governmental agency that oversees aquaculture, other ocean stakeholders, and the general public should be included in the site planning process.
- **Requirements for species composition.** Aquaculture should not introduce nonnative species into ecosystems in which they do not naturally occur. Under the precautionary principle, genetically modified organisms should also not be allowed.
- **Full traceability.** The Seafood Import Monitoring Program requires certain imported aquaculture products to comply with traceability requirements. NOAA has already taken steps<sup>77</sup> to institute similar requirements for some U.S.-raised aquaculture products, which should be expanded to all U.S.-based aquaculture and aquaculture feed products—including forage fish, which are not currently included.

- **Inspection and enforcement provisions.** Monitoring should include both environmental considerations—including seabed impacts from waste or chemicals used on the farm and changes in the surrounding ecosystem—and operational concerns such as escapement controls, equipment integrity, and labor concerns. The federal agency overseeing operations should be equipped to engage in unannounced inspections.
- **Discharge standards and monitoring.** Fed and unfed systems have water quality concerns due to the potential effects of excess feed, dead fish, fish waste, and pseudofeces. These types of operations require robust oversight to ensure that Clean Water Act requirements and other environmental protection standards are met.<sup>78</sup>
- **Stock sourcing.** Certain types of aquaculture farms such as bluefin tuna are stocked with wild-caught juveniles. This should be phased out over a reasonable number of years; American aquaculture should not rely on wild-caught juveniles indefinitely.
- **Clean up.** Programs should be in place to address spills, failed companies, or other adverse effects that derelict aquaculture facilities may pose to the surrounding environment.

Aquaculture systems that require feed should also address feed sourcing and human rights standards. Fishmeal and fish oil used should be required to adhere to sustainability and traceability standards with the goal of minimizing wild fishery interactions and human rights abuses.

# Conclusion: Moving forward

As climate change and coastal population growth put pressure on traditional commercial fisheries, aquaculture has offered working waterfronts another avenue of economic opportunity. Unfed aquaculture—shellfish and seaweed—have benefitted communities from Washington to California to Maine and are proven to be compatible with commercial fisheries. However, the lessons of fed aquaculture—namely, salmon farming in the Pacific Northwest—have been very different.

As Congress considers how to support coastal communities, policymakers should look toward the existing and highly successful American approach to unfed aquaculture and consider the benefits of expansion into federal waters. Expanding fed aquaculture will require a careful and deliberative approach, however. The economic opportunities that aquaculture offers are significant but must be balanced with proper regulations that ensure sound siting, species selection, and farm management practices as well as deploy advanced technology to ensure environmental protections.

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## About the authors

**Alexandra Carter** is the ocean policy analyst at the Center for American Progress. Carter has previously worked at the U.S. Senate; the California and Oregon Departments of Fish and Wildlife; and as a National Oceanic and Atmospheric Administration-certified fisheries observer in the Bering Sea, Alaska.

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# Appendix:

## Additional topics for consideration

**Occupational health and safety** is often overlooked or lumped into agricultural or other loosely associated regulatory statutes.<sup>79</sup> Aquaculture development will spur jobs, and those jobs should be sufficiently covered by a policy that is suited to the specialized risks associated with offshore aquaculture work.

**Labor abuses** in seafood are shockingly common.<sup>80</sup> American offshore aquaculture should promote quality jobs with living wages and product-traceability in domestic seafood production. Feed should be held to the same high sustainability and labor standards as the aquaculture product itself.

**Veterinary drug use** is necessary to prevent and treat disease within aquaculture systems, but under-regulated use poses environmental and public health risks.<sup>81</sup> Improperly regulated use of antimicrobial drugs can lead to antimicrobial resistance and the presence of drug residues in aquaculture products. Antimicrobial resistance within humans can cause prolonged illness, increased hospitalization rates, and higher mortality rates. If aquaculture expands in the United States, measures should be taken to study the phenomenon and to prevent the spread of antimicrobial resistance.

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As progressives, we believe America should be a land of boundless opportunity, where people can climb the ladder of economic mobility. We believe we owe it to future generations to protect the planet and promote peace and shared global prosperity.

And we believe an effective government can earn the trust of the American people, champion the common good over narrow self-interest, and harness the strength of our diversity.

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We develop new policy ideas, challenge the media to cover the issues that truly matter, and shape the national debate. With policy teams in major issue areas, American Progress can think creatively at the cross-section of traditional boundaries to develop ideas for policymakers that lead to real change. By employing an extensive communications and outreach effort that we adapt to a rapidly changing media landscape, we move our ideas aggressively in the national policy debate.

