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Localism "Reimagined": Building a Robust Localist Paradigm for Overcoming Emerging Conservation Challenges

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Abstract

Governance gaps at both the federal and state level increasingly necessitate local action and remain a key driver of community-based solutions. A localist paradigm—encompassing models such as community-based management, citizen science, and cooperative research—offers a promising approach for bridging governance gaps by engaging citizens, co-producing knowledge, fostering trust, and developing innovative solutions to address complex conservation challenges. Yet, despite notable successes, significant barriers constrain widespread implementation of localist approaches. This is particularly evident in natural resource-dependent communities. Rural communities are increasingly faced with a range of conservation challenges related to rapid climate and land-use changes but often they lack the capacity to support locally based initiatives to better anticipate, plan for, and mitigate these changes. We examined four diverse conservation cases based on localist approaches in Maine, USA, to bring to the fore key factors that influence outcomes in different social-ecological contexts. We compared cases along three frequently discussed dimensions—governance systems, social adaptive capacities, and technology and data characteristics and found that localist outcomes vary widely depending on key metrics within each of these dimensions. There is no single way to advance localism, but we offer multiple ways to incorporate a community-based perspective into management. This synthesis of data from our collective participatory research projects provides guidance to maximize the potential of localist conservation approaches in complex social and biophysical arenas.

Keywords Localism · Community-based conservation · Social adaptive capacities · Governance systems

Introduction

Place-based community engagement in natural resource conservation is supported by the growing recognition that traditional "top-down" management approaches are insufficient to conserve natural resources and sustain the local communities that depend on them (Agrawal and Gibson 1999; Armitage et al. 2009; Berkes and Folke 1998; Gruber 2010; Ostrom 1990; Pinkerton 1989). While not a new management paradigm (Brick et al. 2001; McGinnis et al. 1999; Weber 2000; Wondolleck and Yaffee 2000), a focus on local action and community-based solutions has gained attention in the United States as the federal government takes aim at core environmental protections (Creed et al. 2017). In response to regulatory rollbacks and withdrawal of federal and state government from key public policy arenas, new forms of localism have emerged in the USA to fill governance gaps in natural resources conservation (i.e., Levesque et al. 2019).

Governance includes the structures and processes by which societies share power and shape individual and collective action (Lebel et al. 2006; Young 1992). As an alternative form of governance, localism includes a continuum of approaches varying in degree of power-sharing and integration of local and centralized management systems from more "top-down" to co-management (Pomeroy and Berkes 1997). These governance regimes are nested in

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institutional arrangements operating at higher levels that may directly drive their performance (Young 2010). For example, traditional "top-down" management mechanisms (e.g., regulatory approaches or other prescriptive measures) can be place based in scale. Although promulgated from above, enforcement of environmental laws and regulations is often the responsibility of local or regional governmental agencies whose policies and programs address local issues or management concerns (e.g., water quality and wildlife habitat). While localist approaches can be citizen or stakeholder initiated, they are still embedded within a "top-down" institutional structure that creates particular roles and rules for government participants (Koontz et al. 2004; Pomeroy and Berkes 1997; Tengo and Hammer 2003). Government agencies are often collaborators and partners to localist entities, and may act as facilitators, or be an important source of funding and technical resources (Koontz et al. 2004; Mason 2008). Different levels of devolution of power result in a broad spectrum of collaborative arrangements between governmental and non-governmental actors that range from government-led to co-management situations (Gelcich et al. 2006; Holling 1978). In a co-management approach, different methods of sharing power, exercising responsibility, and ensuring accountability structure interactions among actors and institutions (Armitage et al. 2009; McGreavy et al. 2018). Although localism may take different forms, localist approaches are distinguished from centralized government management by an explicit emphasis on engaged practices to empower communities, draw on local expertise, build local capacity, enhance local identity (Dinnie and Fischer 2019; Madanipour and Davoudi 2015; Taylor 2007), and support local actors, including governments and communities, to better anticipate, manage, and plan for rapid social and environmental change (Allen 2006; Chen et al. 2006; Dumaru 2010; Pearce 2003).

Faced with rapid climate and landscape change, shifting local economies, and unplanned development in valuable resource areas, rural communities are often hardest hit because they lack the civic resources that would enable them to prepare for, identify, and respond to complex global social-environmental change. Localism offers a promising model to address conservation challenges in rural communities in which economies are often linked to natural resources, and rural communities are increasingly encouraged to become involved in local environmental planning decisions (Featherstone et al. 2012; Weber 2000). Yet, because localist approaches are embedded in complex social-ecological systems, they are inherently challenging (Armitage 2005; Berkes and Folke 2008; Gruber 2010, Kellert et al. 2010), making a "one-size-fits-all" approach to localism ineffective (Wondolleck and Yaffee 2017). This demands more creative responses that may include dusting off and adapting existing approaches and developing new strategies to build local capacities and empower rural communities.

Understanding how local approaches are shaped and constrained by complex biophysical, social, political, and economic processes is the first step toward developing effective localist approaches to addressing conservation challenges. As community-based researchers, we saw an opportunity to tease apart the components of localism that may shape outcomes across a wide range of social-ecological contexts. This work emerged from over 50 years of collective research experiences in rural, natural resource-dependent communities faced with significant conservation challenges. While we recognize the complementary nature and the complexity of multi-scale governance regimes (Lebel et al. 2006), our focus here is on place-based initiatives that engage stakeholders, such as rural landowners, fishers, or volunteer conservation groups, who often function outside of or collaborate within traditional governance mechanisms. We selected the conservation cases from the portfolio of research projects in which we are involved because this diverse set of cases addressed the balance between socio-economic and conservation goals, involved diverse stakeholders, and represented multiple years of university-led research and engagement. These cases also had important similarities in their geographic location and social-ecological system focus which made them amenable to systematic comparison. Cases include community-based fisheries management, conservation of wetlands on private lands, and sustainable renewable energy development. Within these broader conservation contexts, we draw on four discrete cases: river herring, shellfish, vernal pools, and tidal power. Our purpose is to identify key characteristics of the biophysical, social, and political systems that may either serve as catalysts to enable and sustain localism or that may create potential obstacles to effective localist outcomes. While we focus on cases in Maine, USA, we believe that learning across our groups' differences provides guidance for a "reimagined" localist paradigm relevant to other natural resource issues embedded in multi-level governmental regulatory environments.

Methods

As a group of researchers independently working on stakeholder-driven, community-based conservation in rural Maine, we saw an opportunity to share experiences and explore how to strengthen outcomes for natural resources and the communities that depend on them. Collectively, the communities and natural resource issues we were working with provided a unique opportunity to investigate management challenges pertaining to natural resources conservation in rural communities in at least three ways. First, all cases involved collaboration or cooperation between governmental and nongovernmental actors, with multiple stakeholders engaged (e.g., federal, state, and local government officials, local or regional conservation organizations, and community members). Second, cases represented different degrees of devolution and explicit governmental control (e.g., regulatory driven to co-managed) leading to different roles and responsibilities for government stakeholders and different pathways of knowledge exchange among the actors and institutions. Lastly, all four cases had an engaged research component that focused on understanding the role of local knowledge in decision-making processes and on supporting opportunities for knowledge sharing and integration among different actors and decision scales.

Study Area

Our "study area", the four case studies (outlined in Table 1), spanned diverse natural systems, governance scenarios, and socio-economic challenges. The thumbnail profiles we provide here lay the foundation for our analyses of key drivers and outcomes.

Vernal pools

Vernal pools are a unique wetland type defined by a suite of amphibian species dependent upon them for optimal reproductive success, namely, wood frogs (*Lithobates sylvaticus*) and ambystomatid salamanders (*Amybstoma* spp.). Vernal pools are relatively small, ephemeral wetlands that typically fill with water in the spring and often dry by summer's end ensuring pools are fishless and have reduced invertebrate predator loads. Because vernal pool habitat for amphibians includes the adjacent forest where the pool-breeding amphibians spend > 95% of their life history, managing the pool-plus-forest system is a conservation challenge.

Impacts to vernal pools in the northeastern USA are regulated by federal and state agencies (Mahaney and Klemens 2008). More recently, in response to regulatory backlash coupled with the recognition that current regulations fall short in providing landscape-scale protections for pool ecosystems, a diverse stakeholder group of regulators, economists, developers, towns, land trusts, scientists, and policy experts met for 7 years to develop a novel pool regulatory tool, the Maine Vernal Pool Special Area Management Plan (VP SAMP) (Calhoun et al. 2014; Levesque et al. 2016, 2019), which provides a voluntary, local in-lieu fee mitigation program for municipalities that will lead to both better economic and ecological outcomes for towns.

Tidal power

For nearly a decade, the Maine-based Ocean Renewable Power Company has been working in eastern Maine to develop new technologies designed to capture energy from the natural movement of the areas 7-m/2x daily tides, generally referred to as marine hydrokinetic energy. This region also boasts a unique and valuable natural environment, including iconic physical (largest whirlpool in western hemisphere), biological (habitat for endangered marine mammals), and social components (important traditional and commercial fishing grounds). An array of federal and state agencies asserts jurisdiction over the tidal power project; the Federal Energy Regulatory Commission (FERC) is the lead permitting authority, but the project is also subject to permitting by the US Army Corps of Engineers, coastal zone management consistency determinations at the state level, granting of leases, easements of state-owned aquatic lands, and certifications under several statutes, including the Clean Water Act. Additionally, federal and state agencies comment on the proposed project pursuant to the Endangered Species Act, Marine Mammal Protection Act, and Magnuson Stevens Fisheries Conservation and Management Act. Tidal power development in eastern Maine is occurring within the context of high system complexity (dynamic coastal environment) and significant uncertainty (nascent technology development), making input from scientists, developers, regulators, and the local community critically important to move marine renewable energy development forward in a way that is socially acceptable and environmentally responsible.

River herring

Maine's river herring fishery consists of both alewife (*Alosa pseudoharengus*) and, less commonly, blueback herring (*A. aestivalis*). They are anadromous species, maturing at sea until approximately age 3–5, and returning to freshwater lakes and ponds to spawn; bluebacks typically spawn in the main stem of rivers and streams. River herring are an important economic resource for coastal communities and a source of bait for the lobstering industry (Hayden et al. 2019). In 2015, harvesters in local communities brought 1,295,998 lbs of river herring to market, valued at $415,433 (MEDMR 2017). Furthermore, the fishery has supported a local fishing culture in Maine communities for generations. Although previously abundant, since the 1600s and 1700s, numerous stressors have depleted the population, namely, dam development that restricts access to spawning grounds, ecosystem decline, fishing pressures, and predation (NOAA 2009). River herring are considered an indicator species (reflecting the general health of the coastal ecosystem) (Hayden et al. 2019) and critical in the food web such that

Table 1 Conservation cases, Maine, USA

	Conservation challenge	Stakeholders	Degree of government control	Community-based research	Sample relevant publications
River herring	River herring face numerous threats from dam development to overfishing to predation. With a life cycle that involves migration from the sea to inland waters and back, managing this resource requires a collaborative, regional approach that is also highly local. Resources, loose networks, geography, and low public education about the resource complicate conservation of this resource.	Alewife harvesters Lobster fishermen and women Fish committees and wardens Municipal officials Social and biophysical scientists Resource managers Tribal governments Local land trusts Lake and pond associations Private landowners Sporting camp owners	Co-management approach with joint responsibility among local municipalities, state resource managers, and regional and federal resource managers.	Community-based research has included social and biophysical research on the resource. Social science studies have been commissioned to inform Alewife Harvesters of Maine planning and development, to identify effective community-based approaches to natural resource management, and to explore the role and impact of citizen science in fisheries management. Biophysical studies have focused on understanding the biology of river herring to inform resource sustainability and that responds to questions from communities.	Bieluch et al. (2014, 2015, 2017), Smith et al. (2015), Bieluch and AHM Board of Directors (2014), Cournane and Glass (2014)
Vernal pools	Conservation of pools requires protections for both the pool footprint and the adjacent forest. These are often on relatively small parcels of private land and often cross landowner boundaries. Only a vast minority of pools are regulated.	Private landowners Development community Federal and state wetland regulators Land managers Municipal officials Regional and local land trusts and nonprofits	Regulation differs at federal, state, and local levels and is not consistent among them. In response, a diverse stakeholder group of regulators, economists, developers, towns, land trusts, scientists, policy experts developed the Maine Vernal Pool Special Area Management Plan (VP SAMP), providing a new regulatory option: a voluntary, local in-lieu fee program for municipalities.	Research has ranged from the efficacy of citizen-science programs to postbreeding habitat requirements of pool-breeding amphibians to effects of forest management and development on vernal pools and developing management tools with diverse stakeholders.	Calhoun and deMaynadier (2004), Calhoun and Klemens (2002), Oscarson and Calhoun (2007), Patrick et al. (2008), Calhoun et al. (2014), Jansujwicz et al. (2013a, b), Levesque et al. (2016), Jansujwicz and Calhoun (2010, 2017).
Tidal power	Tidal power development continues to occur within the context of high system complexity (dynamic coastal environment) and significant uncertainty (nascent technology development), making input from scientists, developers, regulators, and the local community critically important to move marine renewable energy development forward in a way that is socially acceptable and environmentally responsible.	Federal and state regulatory and resource agencies Residents Industry developers Local fishers, business owners, and tribes	FERC licensing (federal) requires mandated federal and state regulatory and resource agency input (i.e., permits and consistency) and significant stakeholder involvement.	A university-led interdisciplinary team of engineers, biologists, oceanographers, and social scientists organized as the Maine Tidal Power Initiative (MTPI) collaborated with tidal power developers, state and federal regulators, and the local community to conduct research on fish assessment and human dimensions, including stakeholder engagement and community acceptance.	Jansujwicz and Johnson (2015a, b), Johnson et al. (2015), Marafino (unpublished data)

Table 1 (continued)

	Conservation challenge	Stakeholders	Degree of government control	Community-based research	Sample relevant publications
Shellfish	Intertidal ecosystems and shellfish species are facing numerous threats due to climate change and globalization. Effective conservation requires local-level management and restoration in ways that coordinate across scales, as decisions made in other municipalities and at the state level affect local conservation outcomes. Shellfishing is important for rural coastal communities that may not have adequate resources to support conservation in a changing climate.	Clammers Shellfish committee members Social and biophysical scientists Municipal officials Water quality specialists Marine patrol Shellfish wardens Shellfish dealers Tribal governments Civic and education organizations	Three levels of government control that directly influence shellfish co-management: local town ordinances that define rules and approaches for shellfish co-management; Maine Department of Marine Resources oversight of town shellfish programs; and state and federal regulation that address the risk of eating contaminated shellfish.	Participants in shellfish co-management have a history of community-based research, supported by academic research organizations such as the Downeast Institute and education events such as the Shellfish Focus Day at the Maine Fishermen's Forum. More recently, the Maine Shellfish Restoration and Resilience Fund has provided seed grants to towns to support community-based research, and there remains a need to improve connections between town-level research projects to support learning and generalizable methods and findings.	McGreavy et al. (under review, 2018), McGreavy and Hart (2017)

the ecosystem has changed with their decline (Hall et al. 2011). Although evidence suggests that the river herring fishery is rebounding, the total stock is nowhere near historic levels.

Maine's river herring fishery faces unique challenges because it represents a co-management system where there is joint responsibility between the Maine Department of Marine Resources (DMR) and municipalities that elect to commercially harvest river herring by adopting a town ordinance to support harvesting (versus closing the run for conservation). Some inland runs are managed with the Maine Inland Fisheries and Wildlife (IF&W) because they issue permits to release fish into inland waters where alewife spawn. Municipalities are responsible for maintaining the ordinance, determining license numbers, and establishing conservation programs. DMR is responsible for working with municipalities in support of the development, implementation, maintenance, and ultimately, approval of their ordinance. Atlantic States Marine Fisheries Commission (ASMFC) and the National Oceanic and Atmospheric Administration (NOAA) are also key actors, issuing requirements to municipalities to demonstrate that the run is sustainable and making determinations about endangered species listing. Thirty-five municipalities in Maine have commercial harvesting rights, although only a little more than half are open for harvesting.

Shellfish

Maine's shellfishery, including soft-shell clams (*Mya arenaria*) and blue mussels (*Mytilus edulis*), depends on a healthy intertidal ecosystem and effective natural resource management. The soft-shell clam fishery is especially important, as it is one of the largest fisheries in the State of Maine. Shellfishing has been a livelihood and way of life on Maine's coasts for thousands of years. Clams and mussels continue to provide an important source of income for ~1500 licensed harvesters supplying more than 60% of the US domestic market for shellfish (Evans et al. 2016; Hanna 2000). Today, 74 out of 77 of Maine coastal towns co-manage their shellfish resources, representing 58 total shellfish programs, and 4 area biologists are responsible for providing science, policy, and administrative support to these municipal programs (McGreavy et al. 2018). The Maine DMR shares responsibility with towns to steward the soft-shell clam resource as determined by state statute (Title 12, Chapter 623). Municipal shellfish ordinances are administered by local shellfish committees with state oversight. Towns with approved shellfish programs can restrict entry, charge license fees, require town residency for access, restrict the quantity of harvest, set seasons, open and close areas to harvest, and lease up to 25% of their intertidal area. The state requires licensing, defines acceptable harvest tools, sets a minimum harvest size and tolerance, and monitors public health.

Despite the co-management approach and economic and cultural values of shellfishing, there are many indications that the soft-shell clam fishery is in trouble. For example, clam landings, or the weight of clams brought to market and sold every year, have experienced a 75% decline in the last 40 years (Beal et al. 2016). Efforts to address challenges within this fishery through state-wide legislation, such as policies that would change the legal size limits for harvest or create restrictions on digging to coincide with seasonal spawning events, are generally advanced quickly and without the necessary public processes that could enrich the proposals, identify strategies to balance trade-offs, and ultimately cultivate the public support that is needed for successful legislation.

Structured Team Dialogues

To facilitate comparison and analysis of the cases, we engaged in a year-long series of structured dialogues. We used this iterative series of collaborative team discussions (or "structured dialogues") to identify key characteristics and factors influencing localist outcomes across our four discrete conservation cases in Maine. This approach to conducting cross-case syntheses of previously independent case studies treats each individual case as a separate study and aggregates findings across the set of studies, as described in case study methodology (Yin 2003). As lead researchers on the conservation cases, we were the primary participants in the structured dialogues. We drew on project data from our related research, including surveys of and interviews with key stakeholders, and observations of key activities in each system (e.g., Bieluch et al. 2017; Jansujwicz et al. 2013a, b; Jansujwicz and Johnson 2015a, b; Johnson et al. 2015; Levesque et al. 2016; McGreavy et al. 2018). While our related studies often had multiple foci, when revisiting our data, we focused on data that helped us understand stakeholder perceptions of the conservation challenge and decision processes and roles and relationships among the various actors in each system. Two additional researchers (also co-authors) were engaged to facilitate the structured dialogues, organize case study information, and take detailed notes.

The first series of dialogues drew on our collective experiences to break down the concept of localism by identifying common components across the representative cases. Initial dialogues took the form of brainstorming with the following prompts: how do we capture various forms of localism? What are the factors that shape the decision-making processes and influence outcomes in our respective cases? Data from these initial discussions were coded and used to develop spidergrams that formed the basis for future dialogues.

Spidergrams are an effective approach to tease out emergent components of localism. This visualization technique is used for analysis in many disciplines to facilitate an understanding of how process factors may lead to certain observed outcomes (e.g., Hybsiva and Leppink 2015; Konstantinova et al. 2017). For example, this approach has been used to analytically evaluate community participation and its relationship with health outcomes (Draper et al. 2010). We used spidergrams to structure the second phase of collaborative team dialogues and to draw visual comparisons among the four conservation cases. We conducted comparative case analysis of the component dimensions of localism and identified key metrics, which characterized these dimensions (see "Results of Structured Dialogues" and Table 2 for an explanation of component dimensions for spidergram development and key metrics). Once key metrics were identified, we developed a ranking system and, following the scale structure of previously published spidergram studies, we rated the metrics on a 1–4 scale to identify nuanced contextual variability across our collective conservation challenges. Each lead researcher assigned ratings as appropriate for our respective conservation case, again drawing on our prior research on and experiences with the respective systems.

Key Findings

Results of Structured Dialogues

Two general themes emerged from our early structured dialogues: motivation and process. Motivation refers to the key drivers of stakeholder engagement in localist approaches. Process describes the various forms that emerged, including participant roles and decision-making strategies. Drawing on these initial findings, we coded detailed discussion notes for: (1) what motivated stakeholder involvement in the localist approach and (2) how the localist process was structured in each case. In coding for motivation, we found that level of regulation and ecosystem threat were important drivers of stakeholder engagement. In coding for process factors, we found that the degree of stakeholder involvement, trust in different forms of knowledge, and available opportunities for learning structured the localist approach. At the same time, our analysis found that data accessibility, availability, standardization, and comprehensiveness also influenced outcomes. Drawing on our analysis of early structured dialogues and a review of the relevant literature, we identified three components of localism that may influence how a localist approach is structured, how it functions, and what outcomes emerge: "governance context", "social adaptive capacities", and "technology and data characteristics" (described in Table 2).

Table 2 Factors affecting conservation outcomes and predictive indicators

Categories	Indicators and criteria None 1	Low 2	Moderate 3	High 4
Panel a: governance context				
Levels of natural resource regulation	Unregulated	Minimal regulation	Regulation at one scale of government	Regulation at multiple scales of government
Ecosystem threats	No threat to ecological communities	Some level of threat to parts of an ecosystem. Ecosystem has sufficient resilience to buffer most negative impacts from the threat.	Multiple and persistent threats that have undermined ecosystem resilience.	Broader-scale resource degradation: multiple and urgent threats related to climate and landscape change; evidence of ecosystem decline.
Approach to natural resources management	Decision-making applies to isolated single resource	Recognition of a management action affecting another resource, but no actions taken in decision-making.	Recognition of related natural resources is reflected in some decision-making.	Highly integrated management of related natural resources.
Level of collaboration	No collaboration among stakeholders. Stakeholders = government, nongovernment, users (and basically anyone who wants to partake)	Low levels of collaboration among stakeholder groups.	Some collaboration among some stakeholder groups.	Strong collaboration among stakeholders.

Categories	None 1	Low 2	Moderate 3	High or many 4
Panel b: social adaptive capacity				
Stakeholder involvement	No stakeholders involved in data collection, processing, analysis, and decision-making.	Marginal involvement of stakeholders involved in data collection and analysis (i.e., contractors).	Stakeholders as receivers of information (i.e., public outreach); some involvement in data collection activities.	Co-production; partnership role; stakeholders involved in project design, data collection, processing, analysis, and use of data in decision-making.
Use of science in decision-making	Science is generally not used in decision-making.	Limited amount of science is used in decision-making. Science may not be available, trusted, or systematically incorporated into informal and formal policies. Use of science is mostly ad hoc.	Science is used in developing some policies at select scales.	Formal mechanisms are in place to enable the use of science in decision-making across scale. These may include science advisory committees, joint scientific research and management planning efforts, active partnerships between managers and researchers in the development of informal and formal policies, and related approaches.
Use of local knowledge and diverse expertise	Local knowledge and diverse expertise is not used nor respected.	Awareness of local knowledge and diverse expertise but not incorporated into decision-making.	Local knowledge and diverse expertise are recognized but used only in some situations. Respect is implicitly demonstrated for these forms of knowledge and expertise.	Local knowledge and diverse expertise are incorporated in decision-making. Respect is explicitly demonstrated for these forms of knowledge and expertise.

Table 2 (continued)

Categories	None 1	Low 2	Moderate 3	High or many 4
Levels of trust among actors—demonstrated commitment	Histories of distrust and a relative lack of trust between individuals, institutions, and across scales of governance.	Trust may exist between select individuals based on unique relationships but is not widely shared across individuals, institutions, and scales of governance.	People representing diverse institutions commonly describe relationships based on trust.	People representing diverse institutions commonly describe relationships based on trust and there is a long history of such trust that serves as a foundation for relationships across scales.
Opportunities for learning about science and local knowledge	No regular, formal, or informal opportunities for learning about science and/or local knowledge.	A small number of mostly informal opportunities for learning.	A combination of informal and formal opportunities for learning that occurs on a regular basis.	Regular, frequent, and diverse opportunities for informal and formal learning.
Categories	None 1	Low 2	Moderate 3	High 4
Panel c: technology and data characteristics				
Standardization of data collection	No regulations or formal protocols for rigorous data collection.	Informal social norms about data collection and these guide how data are collected.	Well-defined protocols	Mandatory protocols
Data comprehensiveness	No data available for decision-making about resource	Minimal data available on select ecosystem components and functions; limited accessibility by decision-makers; disparate data sources; data collection at different temporal and spatial scales.	Moderate high-quality data available to decision-makers; significant data gaps remain; disparate data sources; data collection at different temporal and spatial scales.	Holistic, high-quality data available to decision-makers; systematic integration of data from different sources and temporal/spatial scales.
Availability of long-term data sets (temporal complexity)	Unavailable	Spotty and project specific	Regional efforts, high in some regions, absent in others.	Comprehensive
Extent and coverage of data (spatial complexity)	Unavailable	Spotty and project specific	Regional efforts, high in some regions, absent in others.	Comprehensive
Data accessibility	Not accessible	Limited data accessibility such that it impedes utility.	Data are available but not be in a useable format and/or when needed by decision-makers.	Data are available, in a useable format and when needed by decision-makers.
Use of digital technology in data collection	No technology available for data collection, storage, analysis, and use by decision-makers	Limited amounts of technology available/developed for data collection, storage, analysis, and use by decision-makers.	Moderate amounts of technology available/developed for data collection, storage, analysis, and use by decision-makers.	High amounts of technology available/developed for data collection, storage, analysis, and use by decision-makers.

In the context of our study, governance context refers to "the formal and informal rules, rule-making systems, and actor networks at all levels (local, regional, global) that influence how societies identify, design, and implement conservation actions" (Alexander et al. 2016, p 155). For social adaptive capacity we follow Armitage (2005, p 703) and define the concept as "a critical aspect of resource management that reflects learning and an ability to experiment and foster innovative solutions in complex social and ecological circumstances". In our work, we define social adaptive capacities as the resources (e.g., material, technical, and administrative) and abilities (e.g., training and expertise) that enable communities and individuals to anticipate, respond, and adjust to changing environmental and social conditions (Adger 2000; Berkes and Folke 1998).

In subsequent structured dialogues, we identified key metrics for each component dimension and individually rated the metrics on a 1–4 scale for each case. For example, when considering the factor "governance context", we used a 1 (unregulated) to 4 (regulated at multiple scales of government) metric to evaluate four components of governance: status of regulation, extent of ecosystem threats, approach to natural resource management, and level of collaboration among decision-makers (see Table 2 for an explanation of metrics for each case). The following sections discuss key findings related to the metrics as they are defined and ranked for the three component dimensions: "governance context", "social adaptive capacities", and "technology and data characteristics".

Governance Context

Institutional arrangements and governance context structure the decision-making process (e.g., who is involved, when, and how). Across all four cases, we found a high level of natural resources governance (value of 4) with regulation imposed at multiple governance scales (vernal pools and tidal power), as an imminent management tool (river herring), or as part of a co-management strategy (shellfish and river herring) (Fig. 1). Regulation raised the public profile of the conservation challenge (i.e., loss of habitat, species decline, and resource/fisheries conflicts) and brought local actors to the table, particularly in the case of vernal pools and tidal power.

We found that in the cases that are strongly regulated such as vernal pools and tidal power, clarity of objectives led to a more centralized management approach. For example, a subset of high functioning vernal pools was selected for stricter state-wide regulation. In the case of tidal power, with a different resource profile, clear permitting benchmarks and statutory authorities helped to define study plans and adaptive management strategies. While vernal pools and tidal power are both regulatory driven with rules

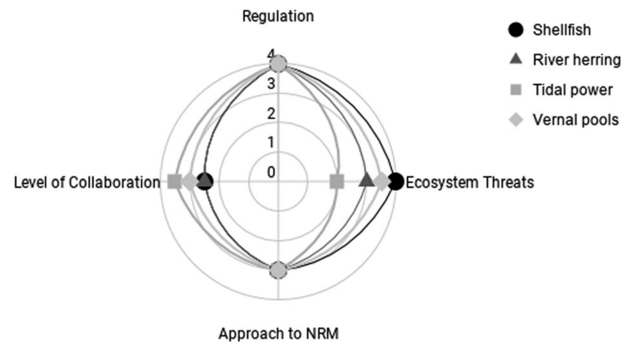

Fig. 1 Influence of governance context on the structure and function of localist approaches across cases

and regulations codified in law and enforced at multiple governance scales, the nature of the regulation (scope and scale) and of stakeholder response to these regulations dictated different approaches and timetables for stakeholder involvement. Backlash against regulation was a motivating factor in the emergence of voluntary approaches and community-based conservation of vernal pools. Strong opposition to top-down vernal pool regulations (Jansujwicz and Calhoun 2010) coupled with the recognition that current regulations fall short in providing landscape-scale protections for pool ecosystems encouraged more creative, voluntary approaches through local participation in citizen-science programs and discussion around municipal protections for pools. Strict guidelines and adherence to formal administrative procedures imposed in the permitting process for tidal power, initiated industry-driven stakeholder engagement processes at specific points in the regulatory process which then provided the formal space for local voices to be heard. A regulatory-driven process also led to clarity in terms of data needs (study requests for tidal power; science behind regulation for vernal pools) and was also the impetus for the higher level of collaboration (including interagency collaboration) in the tidal power and vernal pool cases

In contrast, Maine's river herring fishery faces unique challenges because it represents a co-management system where there is joint responsibility to manage the run (e.g., commercially harvest river herring by adopting a town ordinance versus closing the run for conservation). This structure allows for more diffuse decision authority, with responsibilities delegated to different federal, state, and local management entities (e.g., ASMFC, NOAA, US Fish and Wildlife Service, Maine IF&W, MEDMR, and municipalities), yet stocking determinations, permitting requirements, town ordinances, and species listings structure the decision-making process and account for the high level of natural resource governance (value of 4).

Similarly, for shellfish, Maine also uses a co-management approach with governance of the resource high (value of 4) but shared among state and local municipal entities that are responsible for activities including municipal shellfish ordinances (MEDMR and towns), restricting entry, charging license fees, restricting the quantity of harvest, setting seasons, opening and closing areas to harvest, and granting leases (under the purview of town shellfish programs), and licensing, defining acceptable harvest tools, setting a minimum harvest size and tolerance, and monitoring public health (state agencies).

Ecosystem threat, or level of urgency, emerged as another important factor that explained what motivated a local approach, what brought local actors to the table, and what sustained their dedication. In the case of shellfish (value of 4 for level of ecosystem threat), broader-scale resource degradation and evidence of ecosystem decline motivated clammers to participate in co-management and state policy initiatives to discuss and address options (Fig. 1). For river herring (value of 3 for level of ecosystem threat), municipal involvement was part of the State's historical regulation of the fishery, but the threat of a potential endangered species listing decision made by NOAA likely motivated coordinated, widespread local involvement in the management of this culturally important species. Potential listing of river herring inspired the creation of an organization, Alewife Harvesters of Maine (AHM), that brought unity and voice to the disjointed stakeholder group and also provided resource managers an organization to work with to begin co-creating resource solutions. In comparison, the level of ecosystem threat for tidal power was ranked lower (value of 2) possibly reflecting the sense that tidal power was a "pie in the sky idea;" there is currently no turbine in the water and this low visibility may account for the lack of urgency or organized participation among local stakeholders.

Tidal power ranked highest for the level of collaboration among decision-makers (value of 3.5) (Fig. 1). This reflects the highly structured permitting process and strict requirement that the tidal power developer engage different stakeholders including tribal interests and agency regulators at specific decision points (i.e., study plan design; data dissemination; device testing and deployment). Vernal pool management exhibited a similar level of collaboration among decision-makers (value of 3) perhaps reflecting the same level of required interagency collaboration (Fig. 1). However, in teasing out differences among cases, we noted a higher level of collaboration with local communities in the vernal pool case. This may be explained by the high level of (and long-term) commitment of a novel stakeholder group to using engaged research that integrates local planner and private landowner interests as a means to replace a failing one-size-fits-all approach with a localist, tailored approach (the VP SAMP).

However, while tidal power and vernal pools demonstrate how structured regulations may drive the nature of a collaboration, as well as the extent and timing of stakeholder participation, in a co-management context (shellfish and river herring) where responsibility is shared between the municipality and the state, how people work together and what roles different agencies play in the management process are murkier. We found that while the overarching regulation structures decision-making, language (e.g., "may" and "shall" rather than "will" in shellfish management) and enforcement are less clear. A value of 2 for the river herring and shellfish cases reflects a resource where key licensing and resource extraction decisions are made at a highly local level, yet responsibility for the sustainability of the resource, and the health of it for consumption, still rests with the state, regional, and federal agencies (Fig. 1).

Social Adaptive Capacities

We found that the rural communities in which we work have different capacities to respond to conservation challenges through localist approaches. Across our cases, existing social adaptive capacities affected how a localist approach was mobilized and how the approach gained traction and strength as the decision process unfolded.

Interactions among individual stakeholders, organizations, and communities helped to build and support communication networks, providing space and opportunity for learning, sharing resources, and more effective and efficient knowledge exchange. Network strength was one factor that we identified and explored in our spidergram analysis to explain similarities and differences in capacities across cases (Fig. 2). Network strength was highest in tidal power (value of 4) perhaps reflecting the regulatory-driven stakeholder process and the role of industry developers in driving the process. Network strength in the vernal pools case was also high (value of 3.5). In this case, leadership and local champions (i.e., town planners) were critical in moving localist approaches forward in an innovative way and in

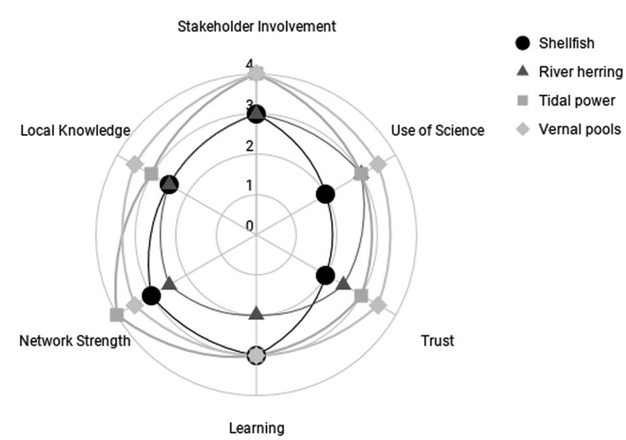

Fig. 2 Influence of social adaptive capacities on the structure and function of localist approaches across cases

securing funding for new conservation tools and approaches (i.e., Maine Vernal Pool SAMP). Low network strength in the river herring case (value of 2.5) reflects a geographically diverse resource, with a generally loose network of resource users, and an informal infrastructure for knowledge sharing and communication across resource users. Furthermore, the season for river herring is relatively short, lasting 1–2 months, which likely contributes to a lag in communication among interested parties between seasons. The nonprofit AHM fulfills both a networking and communication gap, particularly among harvesters and between harvesters and state and federal managers. For the shellfish case, network strength was in a midrange, with a value of 3, because connectivity within the broader municipal shellfish co-management system depends on key actors who are involved in multiple overlapping contexts. In contexts where these actors exist, the individual town programs are connected with other town programs and with efforts at a state level. In places that are more isolated, such as in far Downeast Maine or in shellfish programs that are small and not as active, towns and individuals may not be well connected.

In building social capacities for localism across the different cases, the types of stakeholders involved may matter as much as the level of stakeholder involvement. In the tidal power case, community interests were drawn in at formally identified stages in the regulatory process or as a direct result of university-initiated research; no organized local movement (either in support of or opposition to the tidal power development) organically emerged. Community interest in tidal power and a commitment to stakeholder-engaged research, however, led to spin-off efforts supporting localism (i.e., cooperative fisheries research and citizen science). However, outside of any permitting responsibilities, town officials have not been drawn into the process. This was in strong contrast to the networking and local participation that gave momentum to the vernal pool case. In the case of vernal pools, the diversity of stakeholders involved in various stages of development, research, and outreach kept the issue visible. The towns remained actively involved in the design of new tools and in engaging private property owners; the towns even defended state regulations during state hearings on regulatory rollbacks. In a co-management context (river herring), municipal involvement varies by town. Typically, although not universally, there is greater involvement in towns that have enough data to support opening the run for harvesting. Towns with harvesters and active fish committees or fish wardens seem to have the highest level of municipal involvement, likely because they have dedicated personnel attending to the fishery. In the case of shellfish co-management, key actors in diverse sectors each play important roles in building capacity for a localist approach. For example, towns with an active and highly involved municipal shellfish warden are able to meet their local needs for enforcement but also engage in adaptation projects to help grow the resource, such as rotational conservation closures or clam seeding experiments. The state biologists also exert an important influence on localist capacity, especially when they attend local shellfish meetings to help connect the municipal efforts with state regulations, serve as technical support for conservation activities, or more generally provide a sounding board for brainstorming local initiatives and helping towns learn from related efforts across the coast.

In building social capacities, we also found that levels of trust affected how locally based processes functioned and the outcomes that emerged. Trust in different "forms" of science (e.g., academic research, local and traditional knowledge), in individuals, organizations, and in government structures and processes determined what data were "used" and how the data were managed and shared. As an example of this pattern, in the shellfish case, use of science in decision-making is low (value of 2) and the level of trust and demonstrated commitment is similarly low (value of 2) (Fig. 2). Use of local knowledge in vernal pools (value of 3.5) can possibly be attributed to the high level of local participation in citizen-science projects. Use of local knowledge in the tidal power case (value of 3) was due primary to university-driven stakeholder-engaged research. We also found that how opportunities for learning were structured (i.e., public meetings/information sessions; agency-industry consultation meetings) and whether different communities of decision-makers had capacities to participate in these learning opportunities influenced trust and outcomes. Opportunities for learning scored low in river herring (value of 2) but higher in other cases (values of 3 across board) (Fig. 2). More opportunity for learning may explain the higher level of trust in the vernal pool and tidal power cases. Although opportunities for learning scored low in the river herring case, interviews with participants indicated that, in general, there was trust among stakeholders involved in the industry. Interviews with state and regional managers for river herring revealed that they are more likely to use citizen-science data in their analyses if they know the person who is organizing the citizen-science count and trust that individual's methods.

Data and Technology Characteristics

Nature of data collected, methods of data collection, and data use by stakeholders all influence outcomes (Fig. 3). Standardization and comprehensiveness of data collected were high in tidal power (value of 4) and vernal pools (value of 3.5), presumably due to higher levels of regulation and more stringent environment assessment processes, and hence were readily accepted in crafting management

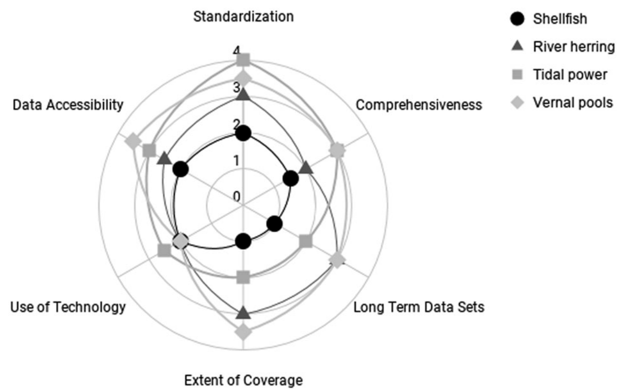

Fig. 3 Influence of data and technology characteristics on the structure and function of localist approaches across cases

strategies. Data accessibility was low for shellfish (value of 2) and river herring (value of 2.5) and only slightly higher for tidal power (value of 3). Only vernal pools indicated a higher value of 3.5 for data accessibility, possibly attributed to long-term stakeholder engagement, higher levels of collaboration, and posting of data by the towns on their website. Work leading up to the VP SAMP highlights the need for improved communication plans for engaging with landowners (with and without vernal pools on their properties), land trusts, and local governments, fostering communication among these players, for improved technologies for data collection and accessibility, and for improving local infrastructure. Interviews and participant observations from the tidal power case (Marafino unpublished data) suggest that access to peer-reviewed data is a significant concern, and proprietary industry information is often not accessible, possibly accounting for the lower value. For river herring, while the state reports run counts and scale sampling results to municipalities, harvesters, and volunteer programs, we consider data accessibility as low for two primary reasons. First, there is no comprehensive, public database that allows access to data across runs. Second, low networking among fisheries stakeholders results in people tending to only know the data for their individual runs but not for other runs in the state. Significant knowledge gaps about the fishery, such as juvenile behavior and yield, exist that undermine fisheries management. In addition, it is difficult to standardize data collection and collect high-quality data at scale (Bieluch et al. 2017). Communities often lack the capacity to sustainably manage their resources, largely due to a lack of personnel to manage the run and analyze data, lack of volunteers to gather data, and knowledge gaps about life histories. Data accessibility was particularly low for shellfish (value of 2) because stock assessment data for soft-shell clams and related shellfish species do not exist. Where towns have conducted their own stock assessments, these data are not shared publicly. Instead, clam landings, or the weight of clams brought to market, are used as a proxy measurement for clam abundance, yet these data have a high amount of uncertainty as many other pressures can cause landings to decline aside from or in addition to any decline in clam populations.

Across the board, use of technology was markedly low (values of 2–2.5) and may indicate a gap in local capacity to systematically collect, store, and process data, which may be a feature and constraint of rural communities in particular (Fig. 3). Data collection, storage, and analysis were further stymied by a lack of sufficient long-term funding and staff/participant turnover that may result in loss of institutional memory and added time to recruit and train new participants. In the case of river herring, some communities have struggled to keep their runs open for harvesting, or to reopen runs that have been closed for conservation, if they lack the data to demonstrate run sustainability. The scarcity of data is often due to a lack of municipal personnel and volunteer capacity to collect the data. Data management at the state agency level has stymied the potential of more widespread conservation outcomes as capacity is limited by time and resources available to support local initiatives (especially in the case of river herring and vernal pools). In addition to access issues, lack of data integration may influence local capacity to use these data. In the tidal power case, site assessment data have been collected by the tidal power developer, including information on benthic species, local hydrodynamics, and bathymetry. University-led research has contributed data on fish interactions with tidal devices and local ecological knowledge of marine species (fish, mammals, and birds). However, data are largely relegated to narrow technical reports, inaccessible academic papers, and in some cases, stored as raw data in spreadsheets or as handwritten notes. Additional sources of relevant data (i.e., local tribal historical and ecological knowledge) remain largely untapped.

Discussion: Learning Across Differences

Localist approaches, by their tailored nature, may be as problematic as "one-size-fits-all" approaches, but attention to the influential metrics we have identified provides useful guidance for the design and implementation of localist strategies that have a higher likelihood of impactful outcomes. Here, we highlight our key findings that bear out the importance of working within existing social-ecological and governance contexts to build adaptive capacities and enhance information exchange and the integration of different forms of knowledge into decision-making processes. This "reimagined" approach to local engagement is designed to improve outcomes across our focal cases and to be generalizable to other "sticky" conservation challenges in and beyond Maine.

Design Community-based Processes to Work Within Existing Governance Contexts

It is important to recognize opportunities and constraints of different institutional arrangements. We learned the importance of understanding how processes and outcomes are shaped by type of governance (i.e., diffuse co-management versus centralized governance) and to devise innovative or "reimagined" solutions that can fit within the current management context. For example, the Maine Vernal Pool SAMP is a voluntary, regulatory tool that sits within the existing governmental regulatory structure. It was codified by amending a federal state permit, developing a memorandum of agreement between federal and state partners, and tailoring the mechanism of implementation to municipal needs through development of local ordinances and memoranda of agreement among local players. Furthermore, in designing processes within existing governance contexts that will build on existing social capital and that will resonate broadly, it is critical to recognize that stakeholder motivations differ. Attention to context (and importantly, the "upfront" time spent on research and outreach to develop this understanding) will help tailor communication strategies and target communication platforms that best address the specific information needs and capacities of stakeholders. For effective implementation of tools such as the vernal pool SAMP, a better understanding of the local context, and particularly of the perceptions and needs of rural landowners and developers, was required. Engaged research and outreach play an important role in the assessment of the local context and in the informed design of communication plans and processes that are better targeted to a diversity of local community and conservation contexts and which pay more direct attention to landowner visions and stewardship strategies.

Formalized interaction among local actors and government agencies (e.g., the tidal power permitting process) can create barriers to participation in decision-making (Armitage et al. 2009), but university-led collaborative partnerships that work within existing institutional arrangements (e.g., public meetings and cooperative fisheries management) can foster cross-scale management linkages and support social learning. The tidal power research team has been working with industry, federal and state agencies, and a local tribe on data integration, co-production of a GIS-based decision support tool, and cooperative data collection (e.g., citizen-science approach to marine mammal data collection and gathering local and traditional knowledge through university-led workshops and community meetings). Engaging local stakeholders outside of the formal regulatory process through cooperative research offers a viable mechanism to ensure that knowledge gaps are filled, that data are accessible and presented in a format that matches the capacities of different stakeholders, and that the information is salient and available to ensure uptake by local decision-makers. Creating learning opportunities associated with or outside of formal administrative procedures can increase stakeholder buy-in and enhance stakeholder participation and engagement in implementation activities critical to ensure long-term sustainability of local solutions across different natural resource contexts including renewable energy development, and local land-use planning.

Focus on Activities, Resources, and Community Structures That Build Social Networks, Foster Trust, and Enhance Knowledge Generation and Sharing

High levels of motivation may increase the rate at which successful institutions develop, however, sustaining these arrangements over time is a significant challenge (Armitage et al. 2009). Our work suggests that a focus on activities, resources, and community structures that build social capacities is an important first step. Outcomes from our respective cases complement insights from studies of local-level institutional capacity building in international contexts that suggest engaging in capacity building, both within local communities and in conjunction with other external actors, may help to buffer social and political vulnerabilities (Allen 2006). Localist outcomes are influenced by the capacity of partners, the nature of the partnerships formed, the breadth of the networks, and level and longevity of funding (Pollock and Whitelaw 2005). Strong networks are important in building social adaptive capacities and in buffering lack of institutional capacities and resources (Levesque et al. 2016). Our cross-case comparison showed that networks range from more formal associations motivated by administrative or regulatory requirements (tidal power) to community initiated (vernal pools) and loose associations (river herring). Explicit attention to activities and structures that strengthen networks by creating and nurturing collaborations that better connect civic institutions may lead to better outcomes. The river herring case offers an illustration of such a boundary spanning organization, the AHM, that served to strengthen networks and pull together diverse groups to inform management. With the development of the AHM, a nonprofit dedicated to advocating for the fishery, hosting trainings to support the fishery, and pulling together diverse groups to inform fishery management, great strides have been made in strengthening the social network in the fishery and increasing municipal, harvester, and public awareness of the fishery. Additionally, significant local efforts have occurred to help overcome threats to the fishery and fill important data and knowledge gaps. Such efforts include the restoration of runs by a variety of organizations and individuals and an increase in the number of citizen science counts of river herring at runs with and without commercial harvests. Similarly, challenges in the shellfishery are also well suited to a localist approach, and citizen science offers one key opportunity for filling data gaps and creating collaborations that connect civic institutions (Calhoun et al. 2003; McGreavy et al. 2016).

Leadership and resources play key roles in sustaining and building networks and in identifying and supporting local leaders or champions (i.e., town planners in the vernal pool case) who can serve as boundary spanners. As our cases show, universities can also play a central boundary spanning role by designing and leading participatory engaged research, by contributing data, technical expertise, and assistance to fill knowledge gaps to meet community needs. Leadership in partnerships also requires responsiveness to and an awareness of each partner's perspectives and expertise, a willingness to learn and adapt, and open, effective, and regular communication among partners (Bieluch 2018). Our findings and long-term commitment to community-based research support previous studies that highlight the importance of frequent stakeholder engagement in activities and the finding that those who engaged in more activities tended to learn more and provide more positive evaluations of outcomes (Plummer et al. 2017). In many instances, university–stakeholder partnerships dissolve when funding dries up or when a student project is completed. This often leaves stakeholders frustrated, disillusioned, and less willing to engage with university researchers in the future (Hart and Silka 2020). However, our long-term commitment to participatory research illustrates how continuous engagement by students and faculty can lead to sustained community participation, stronger relationships and networks, and the institutional memory and resources necessary to effectively and efficiently collect and share data critical for more resilient decisions.

In the context of collaborative resource management, trust influences the acceptance of information and the nature of partnering or sharing of information (Stern and Coleman 2015). Trust is positively related to local stakeholder participation in decision-making yet trust has many dimensions and is conceptualized in many ways (Sabatier et al. 2005; Stern and Coleman 2015). Trust in stakeholders (including managers and policymakers), trust in science and in different forms of knowledge, and trust in how information is shared and used are all important to community-based conservations. Trust affects the types of information that are produced, how the information is generated, and how it is incorporated into decision-making. Collaborative processes that build trust through the development of relationships and social learning, such as engaging citizens and municipalities in citizen science, may enhance trust in different "forms" of science, in individuals, organizations, government structures, and processes and lead to improved outcomes of localist approaches. Individuals and organizations build trust using different criteria, thus the question of how different forms of trust may develop in community-based conservation contexts and their impacts on process outcomes is an important one for advancing natural resource management (Stern and Coleman 2015). The synthesis we provide here drew on over a decade of empirical research in our respective community conservation contexts. Future research and research in other conservation contexts might benefit from the direct participation of stakeholders in evaluating localist outcomes.

Enhance Opportunities for Knowledge Sharing and Use in Decision-making

Ecological and social uncertainty is inherent to governance and studies suggest this uncertainty is best addressed with collaborative processes and the recognition that multiple sources and types of knowledge are relevant to problem solving (Armitage et al. 2009, p 96). Yet, despite the growing recognition of the importance of multiple types of knowledge for decision-making, integrating data from different sources and scales (temporal and spatial) is a challenge. Moreover, characteristics of data such as quality and relevance, how it is managed, and how accessible it is to interested parties may also impede use of these data in decision-making.

We identified data accessibility to be a significant challenge. Researchers and practitioners should explore how to make data repositories/databases accessible and in a format that diverse stakeholders can use. Most of our cases exhibit a latent infrastructure for sharing information; stronger networks and better information sharing processes are something needed across all cases. For example, in the case of vernal pools, new technology on data gathering and analysis could greatly reduce town and citizen fatigue and improve the effectiveness of citizen-science programs. In the tidal power case, current research and outreach is focused on the integration of data sets into a more meaningful and usable form that may enable a more complete understanding of the coastal ecosystem and result in better uptake by decision-makers and acceptance from local stakeholders (Marafino unpublished data). Tidal power represents only one potential new marine use, and local communities are increasingly faced with difficult decisions regarding the use of shared resources. Engaging local stakeholders outside of the formal regulatory process through cooperative research is critical to ensure that knowledge gaps are filled, that data are accessible and presented in a format that matches the capacities of different stakeholders, and that the information is salient and available to ensure uptake by local decision-makers. Building strong university–stakeholder relationships as exemplified in our cases may also alleviate issues of trust or mistrust. Trust is particularly important to collaborative local initiatives, and the experience of working together on decisions builds the trust, structures, and patterns of behavior needed to address future challenges successfully (Sabatier et al. 2005).

University-led engaged research can play an important role in building local research capacities; engaged community-based research can also help to incorporate local and traditional knowledge to make management more relevant. In addition to generating information to support scientific data, local environmental knowledge can provide additional benefits (Gadgil et al. 2003). Local knowledge can improve the knowledge base to respond to change adaptively (Gadgil et al. 2003) and support an adaptive co-management paradigm that combines an adaptive management perspective (e.g., Holling 1978) with sharing of management power and responsibility between government and local resource users (e.g., Pinkerton 1989). For example, local ecological knowledge about the herring and shellfishery resource is used to reevaluate and reshape management practices and rules they are embedded in for improved performance. Our experiences support the importance of developing pathways for traditional knowledge to complement scientific data (Folke et al. 2003; Gadgil et al. 2003; Fenge 1997). Local knowledge also provides important input and feedback to inform the future trajectory of research and outreach practices. These findings resonate with environmental governance and management more broadly in that creating opportunities for engagement of stakeholders in multiple opportunities for learning and sharing their knowledge and experiences is likely to improve outcomes (Plummer et al. 2017). Our exercise in learning across difference offers first steps to identify important practical guidelines for enhancing localism in different conservation contexts. Further research is needed to develop a more nuanced understanding of how different types of learning and strategies for data collection, integration, and sharing enhance social and ecological outcomes.

Conclusion

"Re-imagining" a Localist Paradigm and Crafting Enduring Solutions

While we focus on conservation challenges in rural Maine communities, this synthesis of data from our collective participatory research can improve conservation outcomes for practitioners and provide guidance to researchers to identify factors that maximize the potential of localist conservation approaches in complex social and biophysical arenas. Our cases reveal the interconnected nature of the resource management landscape and demonstrate that a localist paradigm that addresses complex natural resource challenges does not need to be—and rarely is—truly only local. Rather, it is in the interplay of the local and nonlocal where movement for resource protection can happen. Hyper-local solutions often fail due to the lack of local capacity and the narrow view of a resource that is embedded in a larger ecosystem and top-down often fails because it is subject to political whims—including financial resource allocations—and it is never responsive to local priorities and concerns. Somewhere in between is the happy place for localism "reimagined".

Discussions among stakeholders that focus on diverse resources, such as our cases, that use analytical tools, like spidergrams, to facilitate cross-case comparisons can help elucidate factors that influence the effectiveness of localism. While the metrics of importance will likely vary by context (e.g., state by state and country by country), some metrics will be similar, and the process of comparison is useful in numerous settings. Drawing on diverse experiences with localism in Maine our work forges a better connection between theory and practice for enhanced applicability and generalizability in national and international contexts. Cross-case comparisons in international settings often focus on a single species or ecosystem and, as our analysis shows, there is value in comparing across different cases in a shared geographic region and that exhibit SES characteristics. More conversations are needed with researchers, practitioners, and community members engaged in other conservation challenges in different contexts to help further tease apart the components of and effectiveness of "a localism reimagined".

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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