

## Original Article

# The myth of voluntary uptake of proven fishing gear: investigations into the challenges inspiring change in fisheries

Stephen Eayrs<sup>1\*</sup> and Michael Pol <sup>2</sup>

<sup>1</sup>Gulf of Maine Research Institute, 350 Commercial Street, Portland, ME 04101, USA

<sup>2</sup>Massachusetts Division of Marine Fisheries, 836 South Rodney French Blvd, New Bedford, MA 02744, USA

\*Corresponding author: tel: +1 207 228 1659; e-mail: [steve@gmri.org](mailto:steve@gmri.org)

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We describe an investigation into the challenges faced by fishing gear technologists inspiring the voluntary uptake of proven fishing gear by fishers, defined as fishing gear that has satisfied research objectives following field trials between fishers and fishing gear technologists. We applied a multifaceted approach to understand how the uptake rate of this fishing gear can be achieved based on the results of a 3-year ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) topic group on change management in fisheries. This was supported by an online survey and interview of WGFTFB members, comprising mainly of fishing gear technologists and researchers from Europe and North America, and a review of projects in the US Northwest Atlantic to evaluate the performance of fishing gear in close collaboration with fishers. We found that widespread voluntary uptake of proven fishing gear by fishers is rare, and usually takes place over many years if at all. The uptake of this gear was more likely occur in the face of perceived financial benefit or impending regulation, although financial benefit was not always sufficient inducement for fishers change their gear. The effectiveness of outreach programmes to inspire the uptake of this gear was also found to be questionable, and the efficacy of incentives was limited and inconsistent, even if the informational deficit of fishers was low. Few WGFTFB members were found to use change management models such as that by Kotter, and they relied mainly on informal, *ad hoc* approaches to inspire the uptake of proven fishing gear. Based on our findings we posit a need to (i) examine our assumptions about the behaviour of fishers, (ii) augment communication of the results of fishing gear research, (iii) focus on emotions to overcome motivational deficits, and (iv) consider how the application of change management models can improve the ability of fishing gear technologists to inspire the uptake of proven fishing gear by fishers.

**Keywords:** change management, fisher behaviour, fishing technology, incentives, Kotter model, motivation.

## Introduction

Every day on the water, commercial fishers must adjust their fishing activity in response to the vagaries of weather, tide, and current. They must also respond to variation in fishing inputs such as the cost of fuel and ice, and fishing outputs such as catch volume, composition, and value. Less frequently they must respond to regulatory change, and in some fisheries, variation in seabed conditions and presence of protected species, other vessels, fishing gear, and obstacles from other marine industries.

Change is therefore an omnipresent and unavoidable feature of commercial fishing activity in both the short and the long term. However, fishers are often steeped in tradition and

reluctant to voluntarily change their fishing activity (Eayrs *et al.*, 2015), including the adoption of fishing gear proven to increase catching efficiency, gear selectivity, or reduce fuel costs (see, e.g. ICES 2001, 2015, and 2016). This behaviour is called the Paradox of Fishermen (Eayrs *et al.*, 2015), because fishers are overlooking the benefits of using this gear for reasons that may seem unclear, unknown, or illogical.

A fundamental role of fishing gear technologists is to evaluate the performance of new or modified fishing gear. This typically involves measurement of one or more parameters that influence fishing gear performance including operational, catching, and environmental, performance. These evaluations benefit from the

involvement of fishers to promote project relevance and legitimacy, ideally by participating in conceptualizing and planning the project, making their vessel available for use as a testing platform, guiding fieldwork, and assisting in data collection. Reporting the outcomes of these evaluations is also an important role of fishing gear technologists, including outreach activities to inform and attract the interest of other fishers, preferably with fishers acting as project champions or evangelists. A commonly held assumption by fishing gear technologists is that this reporting should guide fisher behaviour and inspire a “rational” response of voluntary gear uptake, particularly when financial benefit or other gain is a demonstrated outcome.

We describe an investigation into this assumption and the challenges faced by fishing gear technologists inspiring the voluntary uptake of new, unregulated fishing gear by fishers, particularly after proven success during collaborative field trials between fishers and fishing gear technologists. This investigation was driven by our long-held frustration and failure to inspire fishers to voluntarily adopt proven fishing gear, despite applying what we considered to be best practice to engage and inspire them. Solutions and improvements to our approach were therefore sought from the global community of fishing gear technologists, as well as the change management literature, as a first step in attempting to understand why fishers do not respond as we anticipate.

Our investigation included (i) the outcomes of a 3-year ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB) topic group on change management in fisheries, convened to evaluate the applicability of change management theory and principles (see ICES, 2015, 2016, 2017 for details), (ii) evaluation of an anonymous online survey completed by members of the WGFTFB listserv in 2015 to understand their approaches to inspiring change with fishers and their perspectives regarding the propensity of fishers to change, (iii) the outcomes of interviews of WGFTFB members during the 2017 annual meeting describing their successes and challenges inspiring change with fishers, and, (iv) an evaluation into the voluntary uptake by fishers of proven fishing gear in the US Northwest Atlantic, based on review of two public databases of fishing technology research, and personal experience by the authors over several decades. The WGFTFB is a global network of fishing gear technologists and researchers with a primary focus on fishing gear research and development in North American and European waters. The WGFTFB meet annually to present the findings of fishing gear technology research and hold topic group meetings, during which a subset of the larger membership work on issues of broader relevance to the membership. Each year the findings of the topic group are reported to plenary for review and comment, and at the conclusion of the topic group a report describing findings is presented to the ICES Science Committee (SCICOM). The WGFTFB meeting has a typical attendance of approximately 40–50 fishing gear technologists and researchers.

Here we describe our findings on the separate topics of (i) the likelihood of voluntary uptake by fishers of proven fishing gear, (ii) the application of change management theory and principles to help fishing gear technologists inspire their uptake of proven fishing gear, (iii) the efficacy of incentives, and (iv) steps to increase the future uptake of this fishing gear by fishers. Fundamental to our investigation was an assumption that we could inspire the voluntary uptake of proven gear by fishers after receipt of evidence that using this gear is in their best interest,

including financial benefit or other gain. We also assumed most other fishing gear technologists held the same assumption, as many had expressed similar challenges despite using similar approaches to inspire the adoption of proven fishing gear, and we assumed a more effective approach or process existed that we could apply to improve our effectiveness as fishing gear technologists.

## Methodology

### WGFTFB topic group on change management in fisheries

We convened a topic group meeting on change management in fisheries as part of the annual ICES-FAO WGFTFB meeting in Lisbon, Portugal (2015), Mérida, Mexico (2016), and Nelson, New Zealand (2017). A total of 38 attendees participated in the topic group meetings, representing 16 countries primarily in Europe and North America, and often included senior and experienced researchers. Each year, approximately 15 individuals participated, with the majority of participants new to the group; only the authors participated every year, primarily because meeting locations outside of North America and Europe constrained the ability of many members to attend. Prior to the first meeting, WGFTFB members interested in this topic group were asked to review their experiences facilitating change with the fishing industry, including the voluntary uptake of proven fishing gear and equipment, and present a summary of their findings at the meeting. Theory and principles of change management were presented at the meeting, including definitions of change, types of change, and the Kotter change management model (see Eayrs *et al.*, 2015). This model was selected as a useful starting point because we perceived it provided a clear, step-wise, and logical approach to inspiring change, although we were aware of the presence of other models designed to guide change initiatives. We were also unaware of the use of this or any other change management model used in a fishery context.

A general discussion then followed including lessons learned working with fishers, the role of incentives to inspire their voluntary uptake of proven fishing gear, and the challenges of overcoming fear and building trust with fishers. In the second meeting, participants were asked to present a case study describing efforts to facilitate the voluntary uptake of proven fishing gear, and to use the Kotter model to identify and describe steps taken and perceived shortcomings of the effort. They were next split into two groups and given a case study relating to change in the fishing industry, with a goal of applying the Kotter model. The applicability of the Kotter model was then discussed at length. In the final meeting, the focus was to identify and categorize circumstances and approaches that led to successful or unsuccessful uptake of new fishing gear and equipment. This included a facilitated group exercise, where individuals were asked to identify elements necessary for a successful outcome. These elements were then grouped and sorted into broader categories and discussed by the topic group at large.

### WGFTFB online survey

Prior to the meeting in Lisbon, we invited members of the WGFTFB listserv to complete an online survey about change and their perceptions and experiences facilitating change in the fishing industry, including the voluntary uptake by fishers of new and modified unregulated fishing gear. The survey consisted of multiple closed-worded questions requiring respondents to check

their preferences or indicate relevance to multiple categorical variables. Other questions required the respondent to provide a score based on 3-point Likert scale (very important, important, not important), describe why they think fishers are reluctant to change, and provide suggestions to inspire future change in the fishing industry. A total of 48 individuals primarily from Europe and North America responded to the survey.

### WGFTFB interviews

During the WGFTFB meeting in Nelson, we facilitated face-to-face interviews of members and asked them to describe a successful change initiative with fishers, including why they thought the initiative was successful, how they could have made it more successful, and approaches they believe contribute to successful initiatives. A total of 13 individuals from Australia, New Zealand, United States, and Europe were interviewed at this meeting.

### Fisheries databases

Two online project report databases were evaluated: the NOAA Northeast Fisheries Science Center Cooperative Research Program (NCRP) database ([www.nefsc.noaa.gov/coopresearch](http://www.nefsc.noaa.gov/coopresearch)) and the Northeast Consortium (NEC) database ([www.northeastconsortium.org](http://www.northeastconsortium.org)). Historically both programmes were dominant sources of funding for fishing gear research and related topics in the US northeast region. Each database provides access to summary details and reports from projects funded since 2000, although NEC programme summaries were available only up to 2011; the NCRP database contains details from approximately 640 projects and the NEC database from approximately 170 projects. Both programmes required strong fisher input and support and had an explicit requirement for dissemination of results to fishers; the highest priority of the NEC was partnership building between fishers and researchers (Hartley and Robertson, 2006) as well as a specific requirement that 75% of project funding was earmarked to cover fisher costs (Armstrong *et al.*, 2008). This distribution was also designed to enable fisher participation in research, facilitate integration of fisher and researcher knowledge, and help equip the fishing fleet for research participation.

### Findings and outcomes

#### Voluntary uptake by fishers of research outcomes

Not one WGFTFB member participating in the topic group was able to claim predictable uptake by fishers of unregulated fishing gear despite proven success during field trials. This finding was not disputed when reported to plenary, and no one claimed an ability to predict or inspire greater success. At the Lisbon meeting, the uptake of unregulated fishing gear by fishers in the Indian ring seine fishery and the Danish twin trawl fishery was reported (see ICES, 2015) although the group was unable to pinpoint reasons for this success and why it was not repeatable. Interviewees at the final topic group meeting also frequently described their challenges facilitating the voluntary uptake by fishers of proven fishing gear, such as seabird mitigation devices and fuel-efficient trawls (Jenkins, unpublished data), and none claimed an ability to repeatedly and predictably inspire the uptake of this gear.

Our review of previously funded projects resulted in similar findings. We found 145 NCRP-funded projects in the database with a primary focus to improve the catching performance of fishing gear or to reduce discards of commercially important

species. These projects were selected because they had been funded specifically to provide outcomes of direct and immediate economic benefit to fishers. This was consistent with our initial assumption that fishers respond to economic incentives, while other projects including those designed to reduce seabed impact or discard mortality, were not considered based on their indirect economic benefit to fishers.

We were unable to identify a single NCRP project that resulted in widespread voluntary uptake of proven fishing gear by fishers, either during the period of funding or subsequently, although we recognize some projects may have preferentially been focused on measuring fishing gear performance to achieve regulatory or other outcomes. Our review of NEC-funded projects yielded a similar outcome; from 37 projects with a focus of fishing gear development and performance we were unable to identify a single project that resulted in widespread uptake of project outcomes by fishers, either during the period of funding or subsequently. All projects included multiple outreach activities to inform fishers of project outcomes, including presentation at industry meetings, articles in industry literature, and reports on the NCRP and NEC websites.

The online survey was used to explore similarities between our experience and WGFTFB colleagues', to understand if they were experiencing similar challenges, and to better understand how to inspire the voluntary uptake by fishers of research outcomes. Respondents were primarily government employees (44%) or from academia (27%), and slightly less than 10% were from an NGO or inter-governmental organization (ICES, 2015). We found homogeneity in attitudes between respondents including perceptions of fishers. Most respondents indicated it was the responsibility of fishers themselves (85%), fishing industry organizations (81%), and government bodies (81%) to facilitate voluntary change by fishers, followed by research institutes (73%) and NGOs (52%). Almost 50% of respondents perceived that *fishers do not like change and rarely accept significant change in their fishery*, while slightly fewer (46%) felt that *fishers sometimes embrace and accept significant change in their fishery*. Only 2% of respondents felt *fishers readily embrace and accept significant change in their fishery*. Most respondents indicated that they use face-to-face communication with fishers, fishing industry meetings and workshops, and at-sea training on fishing boats to facilitate change (Table 1). The least commonly used tools were social media, subsidy, and dockside demonstrations. Respondents also felt fishers were reluctant to change fishing gear primarily because of concerns it will be costly or painful, lacks incentive, results in a loss of control, or comes at a time of uncertainty about the future (Table 2). Perceptions that fishers were concerned about appearing incompetent or had insufficient time to adjust to change were considered least important by respondents.

#### Models of facilitating change

The application of formal change management models by WGFTFB members to facilitate change, including the implementation of proven fishing gears, was almost non-existent. Few members indicated knowledge of these models in topic group meetings, at plenary, via the online survey, or during interview. No WGFTFB member in Lisbon described any effort to facilitate voluntary change using a formal change management model, despite a request prior to the meeting to prepare a case study facilitating change with fishers. One member who was engaged as a

**Table 1.** Core tools relied upon by WGFTFB respondents to facilitate change in the fishing industry.

Tool	Responses		Tool	Responses	
	(%)	No.		(%)	No.
Face to face communication with fishers	87.5	42	Phone calls and text messages to fishers	35.4	17
Industry meetings and workshops	81.3	39	Dockside demonstrations	31.3	15
At-sea training on fishing boats	52.1	25	Subsidy (cost underwriting)	25.0	12
Technology transfer	50.0	24	Social media	12.5	6
Project reports	47.9	23	Other	6.3	3
Incentives (gear loans, fishing opportunities)	45.9	22	No response	4.2	2
Industry publications and literature	45.8	22	I do not work with fishers	2.0	1

Source: ICES (2015).

*n* = 48 respondents.

**Table 2.** Perceived relevance of each statement describing why fishers are reluctant to change.

Statement	No. of respondents			<i>n</i>	Weighted average
	Very important	Important	Not important		
Concerns that change will be costly or painful	27	14	1	42	2.62
Perceived lack of incentives to offset any catch loss	26	16	1	43	2.57
Perceived loss of control over their fishing operation/business	29	8	5	42	2.56
Uncertainty about the future, including how they might be influenced or affected by change	25	13	4	42	2.50
Perceived lack of opportunity, benefit, or reward from change	21	17	3	41	2.44
Perceived concerns that change will affect fishers unevenly	21	14	7	42	2.37
Mistrust of individuals responsible for bringing about change, including their motivation	15	23	4	42	2.26
Lack of understanding of the need to change	16	22	5	43	2.24
Concerns that change will have a ripple effect and more changes will be introduced	16	19	7	42	2.21
Concerns that the past, including previous change efforts, will be ignored or dishonoured	11	20	7	38	2.11
Perceived lack of consultation during the change process	14	18	10	42	2.10
Disinterest or apathy in the face of change	11	22	8	41	2.08
Fundamental, pathological, or ideological resistance to change	13	17	13	43	1.98
Insufficient time to become adjusted to the idea of change	7	16	19	42	1.73
Concerns by individuals they will appear incompetent in the face of change	3	15	23	41	1.51

Source: ICES (2015).

Respondents ranked the statements as follows: very important = 3; important = 2; not important = 1. *n* = number of respondents.

private consultant to fishing groups and as a government research scientist presented summary information that captured his lack of success over many years (Table 3), including perceived reasons for this outcome. Other participants, with a combined working experience in fisheries exceeding 200 years, acknowledged similar challenges and frustration. The VALDUVIS tool was presented by one member, and while not considered a change management model because it does not systematically guide individuals through a change initiative, a number of Belgian fishers are voluntarily changing fishing practice and using this tool to demonstrate performance and receive economic reward (Kinds *et al.*, 2016).

During subsequent topic group meetings in 2016 and 2017 (each attended by different WGFTFB members), no one indicated they had used or were using a formal change management model. These individuals were also unable to provide evidence that other WGFTFB members or researchers elsewhere were using these models, in a fisheries context or otherwise.

We found that one interviewee who claimed regular use of the balanced scorecard model (see Kaplin and Norton, 1996 for review) to inspire change in a fishery. We also found several online survey respondents claiming they were using a model of change

management (12.5%), while many indicated they were not (50%) or that it was not applicable in their current position (31%) (ICES, 2015; Eayrs, 2016). One respondent indicated use of the ADKAR model—awareness, desire, knowledge, ability, and reinforcement (see Hiatt, 2006 for review)—to focus on developing the necessary attributes of a change recipient for change to be successful (ICES, 2017). Another indicated use of an integrated sustainability assessment tool; a goal-oriented process to strategically achieve desired change and long-term outcomes (Rotmans, 2006; Poveda and Lipsett, 2011). One respondent indicated the use of an ecosystem approach to fisheries (see Garcia *et al.*, 2003) to guide their efforts while another was guided by various international plans of action and other similar instruments, although these approaches are not change management models because they do not guide individuals systematically through the process of change.

We also found 21% of online respondents combine their formal training on change management with a trial and error approach to facilitate change, while 6% of respondents only apply their formal training, and 33% of respondents have no formal training and only apply a trial and error approach. Collectively these figures support the findings of the topic group meetings,



**Table 3.** Key developmental activities with fishermen, outreach type, and outcome.

Activity	Outreach/promotion	Outcome
• Twin trawl development	<ul style="list-style-type: none"> <li>• Flume tank demonstrations</li> <li>• Instructional pamphlets with measurements</li> <li>• Papers, magazine articles</li> <li>• Report</li> </ul>	<ul style="list-style-type: none"> <li>• Most Danish fishermen converted within first year; profitability increased by 25–35%</li> </ul>
• Twin trawl development	<ul style="list-style-type: none"> <li>• Seafood NZ magazine</li> <li>• Newspaper/media</li> <li>• Annual Seafood Conference</li> <li>• Report</li> <li>• Word of mouth</li> </ul>	<ul style="list-style-type: none"> <li>• Not adopted by New Zealand fishermen</li> </ul>
• Y trawl development	<ul style="list-style-type: none"> <li>• Full-scale trials</li> <li>• Flume tank demonstrations</li> <li>• Training courses and lectures</li> <li>• Fishing papers and magazines</li> <li>• Fishing exhibition</li> <li>• Report</li> </ul>	<ul style="list-style-type: none"> <li>• Not adopted. Too complicated, few understood</li> </ul>
• Flume tank courses by video link	<ul style="list-style-type: none"> <li>• Fishing exhibitions</li> <li>• Fishing News International</li> <li>• Flume tank demonstrations to Norway, Iceland, and the United States</li> </ul>	<ul style="list-style-type: none"> <li>• No interest; participants wanted to travel to tank facility</li> </ul>
• Energy-efficient trawl development (flying doors, net redesign, drop meshes, T90 in belly, and codend)	<ul style="list-style-type: none"> <li>• Fishing News International</li> <li>• Magazine articles in Denmark, Norway, Poland, Iceland, Argentina, Australia, etc.</li> <li>• Conferences in WGFTFB, Denmark, Spain, Iceland, Bangladesh, Mexico</li> </ul>	<ul style="list-style-type: none"> <li>• Limited uptake; too complicated, few understood</li> </ul>
• T90	<ul style="list-style-type: none"> <li>• Full-scale trials</li> <li>• Flume tank demonstrations</li> <li>• Training courses and lectures</li> <li>• Fishing papers and magazines</li> <li>• Reports (refereed)</li> <li>• Pamphlets, brochures</li> <li>• Conferences</li> </ul>	<ul style="list-style-type: none"> <li>• Limited adoption</li> </ul>
• Plate gear	<ul style="list-style-type: none"> <li>• Full-scale trials</li> <li>• Flume tank demonstrations</li> <li>• Fisheries exhibitions</li> <li>• Fishing papers and magazines</li> <li>• Video (free)</li> <li>• Conferences</li> </ul>	<ul style="list-style-type: none"> <li>• Limited adoption; too complicated, too early?</li> </ul>
• Oyster dredge	<ul style="list-style-type: none"> <li>• Full-scale trials</li> <li>• Flume tank demonstrations</li> <li>• Reports</li> </ul>	<ul style="list-style-type: none"> <li>• Too cumbersome? No! Negative attitude from users despite threats of closure</li> </ul>

Source: ICES (2015).

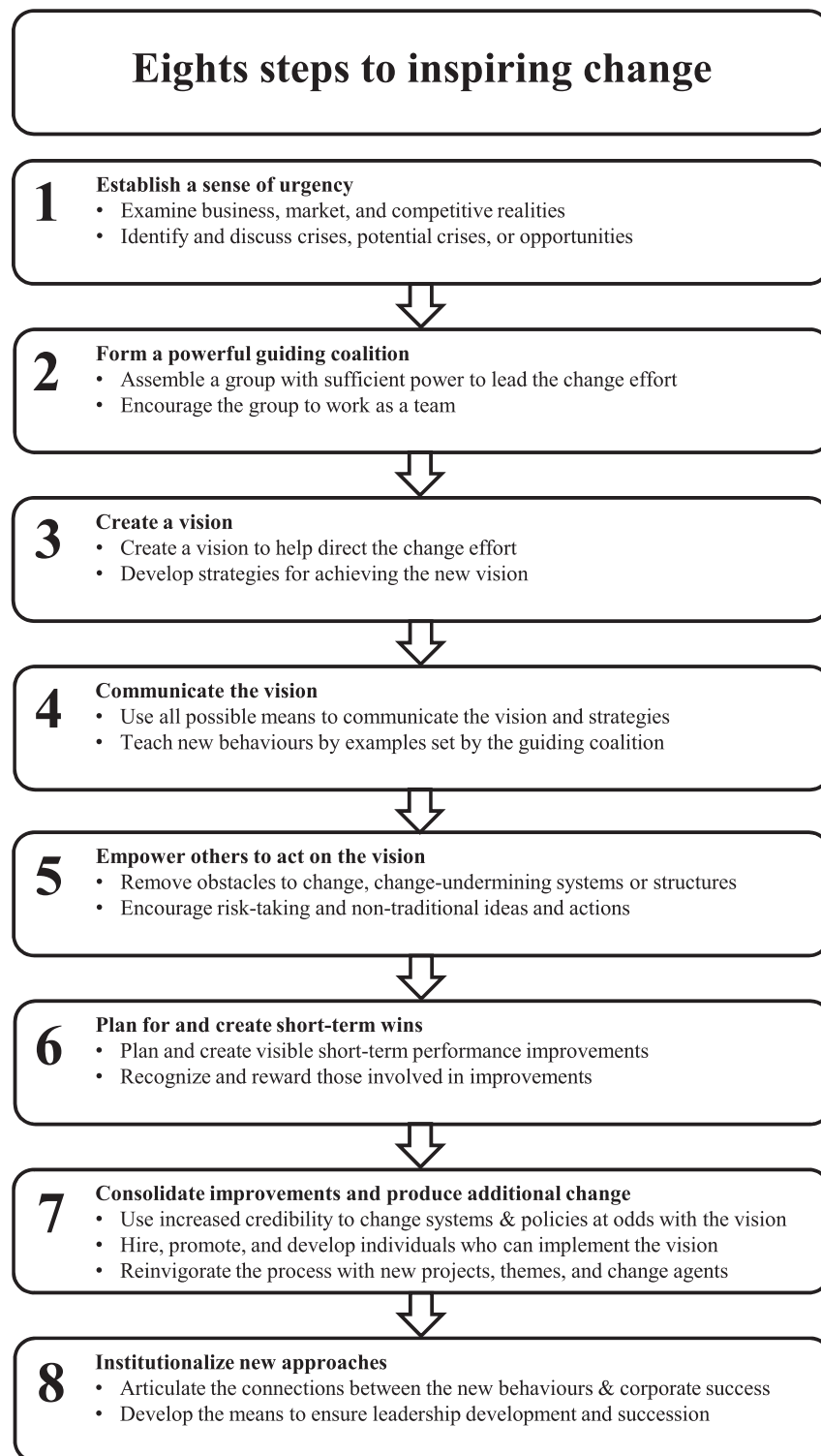
that change management models and their application have seldom been considered previously by the WGFTFB, despite most respondents (73%) indicating a role of their employment was facilitating voluntary adoption by fishers of new or modified fishing gear.

### The Kotter change management model

The Kotter model (Figure 1) was initially presented to the WGFTFB plenary in 2014 (see ICES, 2014) and described in a fisheries context in Eayrs *et al.* (2015). The model is perhaps the most widely used to facilitate change worldwide (Mento *et al.*, 2002; Cameron and Green, 2012) and comprises an eight-step process developed in response to the most commonly observed errors to establishing permanent change within an organization or business (Kotter, 2008, 2011). In the context of our investigation, the model was presented as a new way to consider the

change process, including identifying why past change initiatives with fishers were less successful than anticipated, to evaluate present change initiatives, and to facilitate planning of future initiatives with fishers. It was also presented as a strawman for consideration, to be adopted, refined, or discarded if deemed unsuitable.

To test the utility of the Kotter model, each participant at the second topic group meeting was asked to apply this model to a personal case study related to change in fisheries and present their findings (ICES, 2016). These case studies included initiatives to encourage fishers to adopt new and proven fishing gear, such as semi-pelagic doors, modified trawl sweeps, raised footrope gear, excluder grids, as well as the VALDUVIS tool. All case studies unknowingly incorporated one or more steps of the model, although none applied all steps of the model. A sense of urgency (step 1; Figure 1) inherently existed in each initiative, but no effort was made to evaluate if this was consistent between fishing gear



**Figure 1.** Kotter's eight-step change management model. Reprinted with permission from [Kotter \(1996\)](#). Copyright (2012) by Kotter; all rights reserved.

technologists and fishers involved, or between fishers themselves. A formal guiding coalition (step 2) was seldom a feature of any initiative, and was usually comprised of one or two fishing gear technologists, sometimes supported by a few fishers and/or fishery authorities or others in a loose coalition. Universally, a clear

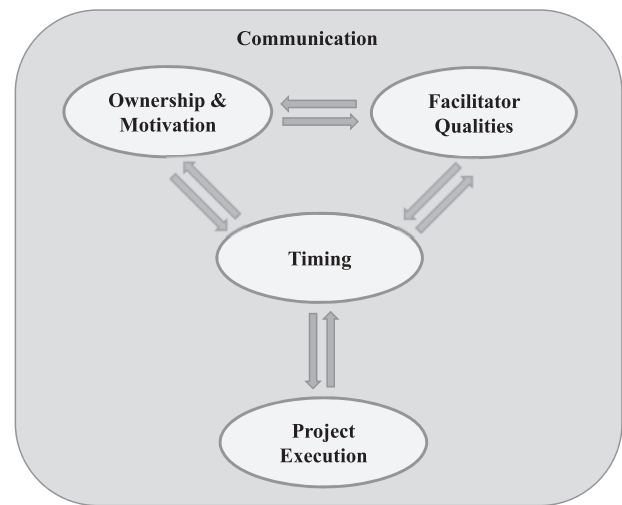
and concise vision to guide the initiative and evaluate success (step 3) was not established or articulated (step 4), and if a vision was known by those leading the initiative, efforts were seldom made to formally extend the vision or evaluate if it was consistent between fishers or others. Efforts to empower fishers to adopt the

vision and change (step 5) were sometimes supported by opportunities to test new gear or behaviour at no or low cost, or with other subsidy, but were briefly or inconsistently applied prior to the conclusion of the initiative. When the project concluded or funds were expended, these opportunities typically came to an abrupt end. Short-term wins (step 6) were often few and far between, such as the purchase by one or more fishers of new fishing gear based on research outcomes, or modified behaviour, and they were often poorly and/or infrequently communicated to the remainder of the fleet. Subsequently, consolidation and additional voluntary change (step 7) of research outcomes was also poor, and institutionalization of new behaviour and associated cultural change (step 8) by the fleet was rare or non-existent.

Only two case studies were presented during the second meeting that resulted in the uptake of research outcomes by a significant number of fishers, but they were supported soon thereafter by regulation. The case studies were from very different fisheries; one was the uptake of an inclined grid in a pandalid shrimp fishery in the Gulf of Maine and the other the uptake of modified sweeps (ground cables) in a bottom trawl fishery in the Bering Sea. The shrimp fishery is an open access fishery characterized by small (<20 m), owner-operated boats and fishers compete for a share of an annual total allowable catch. In contrast, the bottom trawl fishery is characterized by large (27–60 m or more) factory trawlers, owned by large corporations, each holding quota for multiple target species. The presenters of both case studies were unable to determine to what extent knowledge of impending regulation encouraged fishers to use the new gear beforehand, but given the rarity of voluntary uptake we posit that most fishers wait until regulation is certain before affecting required change. In each fishery a sense of urgency purportedly existed—many fishers desired the proposed change—although the remaining steps of the Kotter model were either absent or inconsistently applied, with the exception of cultural change ultimately impressed on the fleet through regulation. Interestingly, in each example regulations were introduced relatively quickly after completion of the research, and although no explanation for this outcome was available, it is tempting to consider a sufficient number of steps in the Kotter model were addressed (unknowingly) to engender a level of support and relatively trouble-free introduction of the new regulations.

### Elements for successful change

In the final topic group meeting, we focused on identifying and classifying elements necessary for a successful change initiative in fisheries (see ICES, 2017). This was a group exercise commencing with each individual noting elements presumed necessary to inspire change and writing each element on a sticky note. Each individual placed their sticky notes on a wall grouped by common characteristic or feature, taking care to group their elements adjacent similar groups identified by earlier individuals. Once this task was completed, pairs of individuals spent several minutes refining these groupings before replacement by another pair; this approach was designed to systematically develop and refine each grouping by consensus. At the conclusion of this exercise, five distinct categories had been identified by the group, labelled *Facilitator* (i.e. a project's leader) *Qualities*, *Project Execution*, *Ownership and Motivation*, *Timing*, and *Communication* (Figure 2).



**Figure 2.** Depiction of core outcomes of facilitated discussion of elements of a successful change initiative.

Limited time permitted only high-level consideration and discussion of each category. The group considered it important that *Facilitator Qualities* include respect, care, and concern for change recipients. Facilitators also need to be persistent, active, hold relevant experience, and be deemed credible by fishers. An individual with close ties to the fishery, preferably with commercial fishing experience, was deemed to be important in order to better appreciate issues and concerns by fishers, foster close engagement with fishers, and build their empathy and trust. Necessary elements of *Project Execution* included preparation, testing, measurement, reporting and outreach. They also included clear identification of roles and responsibilities, and alignment of expectations by all involved in the change initiative. It was deemed important for change facilitators and recipients to demonstrate *Ownership and Motivation*. This category includes taking ownership, or at least responsibility, of a need for change and the development of solutions. The facilitator needs to demonstrate strong leadership skills, personality, and customer-driven focus, and they should be empowered to identify opportunities, overcome threats, and build momentum; in essence they require tacit approval from change recipients and others to drive change to a satisfactory conclusion. The *Timing* of change initiatives was considered important, not just to achieve an outcome by a predetermined time, but to prepare recipients that a solution is required necessitating a change in practice or behaviour. Finally, the group agreed that *Communication* and a communication strategy were fundamental and essential to inspire change, not only to raise awareness of a need to change, but also showcasing progress and achievement of milestones. Communication should be persistent because repetition is necessary for the message to stick and be understood, and a variety of media relevant to the fishing industry should be used to describe progress, including industry newsletters and Facebook, as well as face to face communication.

It is noteworthy that the facilitated interviews generally echoed the same categories relevant to change identified by the topic group, including strong leadership and comprehensive outreach activity. Almost all interviewees commented on the need for appropriate, focused communication using a variety of media, and

the importance of communicating repeatedly to fishers and others affected by a change initiative. We judged that the categories identified by the topic group and facilitated interviews show strong overlap with the Kotter model.

### Incentives

The use of incentives to encourage change was raised frequently during topic group meetings and reports to plenary. This is consistent with a popular understanding that a desired behaviour can be caused by application of appropriate incentives, for example increasing the adoption rate of a new innovation by increasing the relative advantage of early adopters (Rogers, 2003; McKenzie-Mohr, 2011).

In our investigation, a few members of the WGFTFB topic group felt that direct financial incentives were important to encouraging uptake of proven fishing gear or other change, while many others recalled these incentives had not produced the desired outcome. In one such example, a \$2500 rebate to encourage the purchase of semi-pelagic trawl doors by fishers in New England proved of limited effectiveness at a time when fuel prices were at a historic high (see ICES, 2016). Only a few fishers took up this opportunity despite evidence they reduce fuel consumption by 10% and return on investment could be one year or less. A loan programme was also offered for fishers requiring finance, with repayments capped at 10% of their annual fuel costs to match repayment with quantified fuel savings. To this day, it remains unclear why so few fishers took up this opportunity (some even lauded its innovativeness), although several fishers suggested the timing was awry given fleet-wide concerns over recent changes in fishery regulation. In other examples, one of the interviewees reported that financial incentives had little impact on the adoption rate of seabird mitigation devices by fishers, while another indicated limited interest in a competition to develop bycatch reduction devices, despite a monetary prize worth several thousand dollars. Examples were also provided where indirect financial incentives had not encouraged uptake of new gear, such as the provision of fuel flow meters at no cost despite quantified evidence of potential fuel saving (ICES, 2016). In our experience, we have also witnessed a lack of responsiveness by fishers to incentives, such as opportunities to test low-drag netting and selective trawl nets (Eayrs *et al*, 2015), and opportunities to pre-emptively test new gear at little or no cost when faced with looming regulation (Eayrs and Pol, 2014; Eayrs, 2016).

One successful example presented to the topic group was the rapid uptake of ring seine fishing in the 1980s by a small number of fishers in Kerala, India, followed by several thousand fishers around the Indian coast over the following decade (ICES, 2015). During this period, seine and boat size increased substantially despite efforts by authorities to curb fishing effort. No rationale for the pace of adoption was provided, but we posit that fishers were initially incentivized to use this gear at a time of high catch per unit effort and profitability, and then later to increase boat and gear size to offset dwindling catch rates. This behaviour is not uncommon in many developing fisheries around the world and many examples can be found in the fisheries literature (e.g. Greenberg, 2010; Bolster, 2012; Hilborn, 2012), particularly in the absence of catch limits, and we suspect that behaviour change in the ring seine fishery was incentivized by the prospect of significant and immediate financial profit. However, in other fisheries,

particularly those that are relatively well developed and managed, the use of direct and indirect incentives is seemingly inadequate to inspire change in fisher behaviour, perhaps because the perceived benefit is deemed inadequate to justify a change or takes too long to realize, even if the gear improves profitability.

### Outreach and extension programmes

The efficacy of outreach programmes to inspire the uptake of proven fishing gear by fishers was discussed numerous times by participants in the topic group meetings and plenary (ICES, 2017). We found that the success of these programmes to be highly variable. Many participants had tried multiple informal, *ad hoc* strategies, including flume tank demonstrations, gear testing opportunities, instructional pamphlets, papers, reports in industry literature, presentations at industry meetings, and face to face discussions with fishers on the docks. Typically, these strategies were underpinned by factual justification for the uptake of research outcomes, and while these strategies raised awareness they had little measurable impact on fishers even when faced with the prospect of looming regulation. Not one participant was able to claim a strategy or blend of strategies that regularly or consistently made a measurable difference in the uptake of research outcomes by fishers, let alone provide evidence quantifying the impact of the strategy or strategies. We also found that in the rare instances when fishers adopted research outcomes, it was not possible to identify which particular strategy or strategies were responsible for inspiring their behaviour. Generally, despite their experience, topic group participants could not identify strategies that led to changes in fisher behaviour, let alone their widespread voluntary uptake of research outcomes.

### Discussion

Our study of fishing gear technologists and researchers from North America, Europe, Australia, New Zealand, and elsewhere found ample evidence that the widespread voluntary uptake of proven fishing gear by fishers was rare and takes place over several years or longer if at all. In the few instances where the uptake of this gear was widespread, we found it was usually in response to the prospect of financial gain or impending regulation, and was sporadic or inconsistent. We found no evidence of voluntary gear uptake for other reasons, such as long-term stewardship or protection of fish stocks or the environment. In short, the vast majority of proven fishing gears remain unused by commercial fishers, even if they were closely involved in the research, unless required by regulation to do so.

Our hope of finding strategies, models, or approaches used by other fishing gear technologists to encourage the voluntary uptake of proven fishing gear was unsuccessful. Not one individual was able to claim success across multiple initiatives or projects, and the frustration and bewilderment we experienced was common amongst other fishing gear technologists. Knowledge or study of change behaviour as a means for improving uptake was also scant, as was the application of change management models, and no one was able to pinpoint why uptake rates of proven fishing gear were inconsistent or non-existent. We repeatedly found that factual justification for the uptake of this gear was insufficient to elicit widespread behaviour change by fishers.

While fishing gear technologists are widely successful in their efforts to evaluate the performance of new or modified fishing



gear, their inability to inspire the uptake of this gear begs the question how can they better understand and leverage the behaviour of fishers to be more successful and effective. Fortunately, the readiness of individuals to change and factors relevant to successful change initiatives have attracted study beyond the fields of fisheries and fishing gear technology, and a growing body of literature related to human behaviour and change management provides insight that can be applied in a fisheries context.

According to Attari and Rajagopal (2015), a reluctance to change occurs when individuals suffer from deficits in information and motivation. An informational deficit is a perceived lack of knowledge about a required change, including not knowing why a response is necessary, what response is required, and the likely efficacy of the response. In contrast, a motivational deficit is based on a lack of emotional engagement, and linked to a lack of suitable inspiration or enthusiasm to change. Both may coexist, although with different intensity and influence. In our study, fishing gear technologists reported using a variety of outreach options to share research outcomes to fishers, from oral reports to industry literature to social media, in multiple projects. Sharing of information describing research outcomes is not uncommon (Table 1), however based on these reports and insights using the Kotter model, we believe project outreach is often insufficient in scope, intensity, and frequency to overcome the information deficit of many fishers. We believe this is because (i) project activity is dominated by data collection, entry, analysis, and reporting, leaving limited time for project outreach, (ii) project funding is dominated by vessel time, gear, and other costs, leaving relatively little funding for outreach activity (particularly if the project budget was prepared with a known funding cap), (iii) project outreach frequently suffers from overspending in other project areas, time limitations due to unanticipated delays in other aspects, project fatigue, relative disinterest in an environment that values reporting in scientific journals, and lack of expertise producing outreach material suitable for fishers, and (iv) fishing gear technologists are not always held accountable for the efficacy of outreach activities, particularly if remaining project time is insufficient to quantify their impact, is not measured by funders, or there is little incentive to do so once the project concludes. Subsequently, project outreach activity is often compromised during the period of funding and non-existent thereafter, and unless fishers recall or encounter outreach material post-project, information deficit may be an issue that hampers their uptake of proven fishing gear.

Our results suggest, however, that it is common for fishers to lack suitable motivation to respond to research outcomes despite full knowledge of those outcomes. Motivation has historically been categorized as extrinsic, based on receipt of financial or other reward, or intrinsic, based on an individual's desire to perform a task for its own sake (Benabou and Tirole, 2003; Reiss, 2012). Intrinsic categorization can be refined into 16 core "motivators": acceptance; curiosity; eating; family; honour; idealism; independence; order; physical activity; power; romance; saving; social contact; status; tranquillity; and vengeance (Reiss, 2012), all of which may play a role in behaviour change to a greater or lesser extent. We do not know which of these "motivators" influence the uptake of research outcomes by fishers, their relative influence, or if their influence is consistent between projects, although our survey results (Table 2) suggest that the most important "motivators" are overcoming perceived loss of saving, tranquillity, and independence. Other "motivators"

from the list of 16 that are potentially relevant include perceived lack of acceptance (by peers or others), loss of honour (faith) to traditional values, loss of order, loss of power, and threat to social contact and status. We posit that fisher behaviour can be influenced by a fear of losing one or more of these "motivators", and variation in their intensity and persistence may explain why their uptake rate is low and erratic within and between projects. It may also explain why financial incentives are often inadequate, and a failure to appreciate the impact of these "motivators" and associated fears may explain why fishing gear technologists are so challenged in their efforts to inspire fishers to change. Consistent with this claim, overcoming fear is a central tenet to many change management models including Kotter, as well as established models of human behaviour such as Prospect Theory (see Kahneman and Tversky, 1979) and The Elephant and the Rider (see Heath and Heath, 2010).

A core recommendation from our study is that fishing gear technologists committed to the uptake of proven fishing gear by fishers would benefit from a greater understanding of change management theory and principles, including the importance of motivation in decision-making. Our study found that *ad hoc*, self-developed approaches reported by fishing gear technologists to inspire this uptake show scant and inconsistent success, and that the provision of facts alone is inadequate to achieve this outcome. Our assumptions about the behaviour of fishers, including the Paradox of Fishers, also requires deeper consideration and revision. Consideration should therefore be given to including an expert in human behaviour or change management as a project partner, so they can guide and support engagement with fishers and related outreach activities to improve uptake. Our results also suggest a variety of attributes and actions consistent with the Kotter change management model that are necessary for change to occur. We now consider this model, initially a strawman for consideration in a fisheries context, a relevant approach for guiding change in a considered, systematic, and appropriate manner. Although this model is perceived to have some limitations including concerns it implies change is a linear, systematic process (Jarrett, 2003; Cameron and Green, 2012), we recommend consideration of the steps of the Kotter model (or other similar change management model) when preparing for fishing gear research. During our investigation we found no major shortcomings with the model.

All steps of the Kotter model are important, and special attention to building a sense of urgency, developing a vision, and maintaining frequent appropriate communication both during and after the project is required. Effective use of this model will require deepening of the partnership between fishing gear technologists and fishers, to communicate more effectively and to better understand their emotions and motivations, with a payoff that fishers are better motivated to voluntarily adopt proven fishing gear. Finally, while incentives may play an important but limited early role in facilitating their uptake of this gear, motivating fishers is key to engendering persistent and long-term behavioural change. Deeper investigations are therefore needed into the role of incentives to motivate change in fisher behaviour, including the lure of benefits, financial, or otherwise, as a motivator for change.

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