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# Fish Disease Outreach Messages: Testing of Gain and Loss Frames

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## Cover Page Footnote

Author Note Erin L. Pavloski (nee Jarvie) is currently a visiting Assistant Professor in the Natural and Physical Sciences Department at Olivet College. She previously worked as coordinator of the Mid-Michigan Cooperative Invasive Species Management Area (CISMA) at the Ingham Conservation District, conducting a variety of activities, including aquatic invasive species outreach. She can be contacted at epavloski@olivetcollege.edu. Disclaimers We would like to acknowledge funding from the Michigan State University (MSU) Graduate School, MSU Extension, and Department of Fisheries and Wildlife, including the Dr. Howard A. Tanner Fisheries Excellence Fellowship. We thank the individuals who participated in our study and acknowledge that we offered participant incentives. We also thank our collaborators in the Michigan Department of Natural Resources Fisheries Division. This manuscript was prepared under awards NA140AR4170070 and NA180AR4170102 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Regents of the University of Michigan. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, or the Regents of the University of Michigan and should not be construed to represent any agency determination view or policy. 

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# Fish Disease Outreach Messages: Testing of Gain and Loss Frames

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**Abstract**. Gain and loss framing has been used in risk communication across many fields as a technique for shaping individuals' behaviors. Via community-engaged research conducted with the Michigan Department of Natural Resources, we tested five message frames to determine efficacy for outreach programs. We made the following determinations: (a) for increasing risk perceptions regarding fish disease, a loss frame in a fish disease management context should be used; (b) for decreasing risk perceptions regarding fish disease management, a gain frame in a fish disease context should be used; (c) for motivating behavioral intention regarding prevention and risk reduction, a gain frame in a fish disease context should be used. Our findings are of interest to Extension professionals and others working in natural resources.

## INTRODUCTION

The introduction and spread of aquatic invasive species have affected the Great Lakes and inland lakes (Egan, 2017). In the Great Lakes region, 187 nonindigenous aquatic species are established (Sturtevant et al., 2019). In North America, an estimated 250 nonnative aquatic species from other continents are present (National Park Service, n.d.). Some aquatic invasive species cause fish diseases that pose risks to fisheries, habitats, recreational cultures, and fisheries-related livelihoods. Fisheries management depends on implementation of decontamination behaviors such as cleaning, draining, and drying boats and fishing equipment to slow the transmission of both aquatic invasive species and fish diseases (Connelly et al., 2016; Rothlisberger et al., 2010). Extension professionals working in natural resources and state natural resources agency personnel would benefit from understanding which communication efforts are effective for promoting optimal behaviors.

How outreach information is presented is important because framing of a message can change individual behaviors (Tversky & Kahneman, 1981). The risk communication approach called gain and loss framing is a type of communication framing of outcomes and is used to influence adoption of certain actions or behaviors (Spence & Pidgeon, 2010). Gain frames can describe both the "good things that will happen and the bad things that will not happen," and loss frames can describe the "bad things that will happen as well as the good things that will not happen" (Rothman et al., 2006, p. S203). Gain and loss framing is a technique often used to enhance the probability of success at achieving desired outcomes (Randolph & Viswanath, 2004).

Gain and loss framing has been applied to environmental contexts, and the efficacy of using one frame over the other varies depending on the topic. For example, the use of loss frames was more effective in communicating environmentally responsible behaviors, such as recycling (Davis, 1995). As well, gain framing was more effective for increasing positive attitudes toward climate change mitigation (Spence & Pidgeon, 2010).

Effectiveness of gain and loss framing seems to be context specific, and preventative, risk-reducing behaviors are similar for both aquatic invasive species and fish disease. Because of this circumstance, we sought to discover insights for framing communications about fish disease that can be useful to Extension and natural resources management agency personnel. Throughout the United States, natural resources management agencies communicate with stakeholders about a variety of conservation issues (Alaska Department of Fish and Game, 2011; California Natural Resources Agency, 2014; Michigan Department of Natural Resources [MDNR], 2016b). As an example, the MDNR Fisheries Division communicates regularly about compliance with fishing regulations and behaviors that reduce the spread of invasive species and fish diseases that may threaten fish populations (MDNR, 2016a, 2017, 2018). In 2016, the MDNR Fisheries Division used a gain frame message about fish disease prevention best practices for communication at outreach booths, in online materials, and in the 2016–2017 Michigan Fishing Guide (MDNR, 2016a, 2016b). The

message was "Help Michigan's waters stay world class, put unused bait in the trash!" (see Figure 1, Panel A).

Little is known about the efficacy of communication frames used in fish disease prevention outreach targeted to aquatic recreationists. In this article, we report the results of our research conducted in partnership with the MDNR Fisheries Division. We examined the efficacy of four experimental messages and one control message with regard to risk perception (belief that risk exists) and behavioral intention surrounding prevention of the spread of fish diseases. We sought to test gain and loss communication frames for (a) increasing risk perceptions regarding fish disease; (b) decreasing risk perceptions regarding fish disease management; and (c) motivating fish disease prevention behaviors.

## METHODS

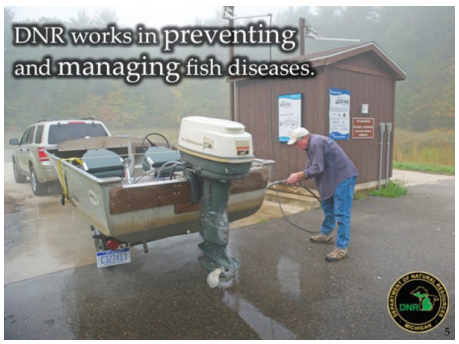
Our community-engaged scholarship is based on foundational scholarship used to inform design and engagement experiences with community partners that then generate new scholarship and practice for both academic and public audiences (Doberneck et al., 2017). Our study was informed by understanding of (a) risk communication gain and loss framing (Tversky & Kahneman, 1981) and (b) risk perceptions related to fish disease (Pavloski et al., 2019; Shaw et al., 2012).

### DATA COLLECTION AND DESIGN

The design for our study was experimental message testing with a convenience sample frame from four 2016 recreation

(a) MDNR Fisheries Division Outreach


(b) Tested Control Frame (Graphic 1)




(c) Tested Gain Frame–Disease (Graphic 1)


(d) Tested Loss Frame–Disease (Graphic 3)


(e) Tested Gain Frame–Disease Management (Graphic 4)


(f) Tested Loss Frame–Disease Management (Graphic 5)


**Figure 1.** Fish disease communication messages, Michigan, 2016.

shows (i.e., Grand Rapids Boat Show in Grand Rapids, Michigan; Outdoorama in Novi, Michigan; Ultimate Sport Show in Grand Rapids, Michigan; West Michigan Women's Expo in Grand Rapids, Michigan). Data collection occurred on Saturdays during the events in two 3-hr shifts (10 a.m.–1 p.m. and 2 p.m.–5 p.m.). The Michigan State University (MSU) Institutional Review Board approved the research (#x15-651e). If participants agreed to be study subjects, confirmed they were age 18 years or older, and provided verbal consent for the study, Erin Pavloski proceeded with administering the questionnaire.

The design of our study is a two-by-two factorial design with a control. Overall, we tested five messages: a gain frame in a fish disease context, a loss frame in a fish disease context, a gain frame in a fish disease management context, a loss frame in a fish disease management context, and a control message that was neither gain nor loss framed (Figure 1, Panels B–F). The messages were created via participatory editing involving representatives from the MDNR Fisheries Division and the Communications Department at MSU (Wates, 2000). Each study participant viewed only one message per interview and messages were shown to participants in rotation, one through five, throughout the interviewing days. The five messages were evenly distributed across participants.

### QUESTIONNAIRE

Before exposing respondents to a message frame, we first asked whether they participated in aquatic-based recreation activities (e.g., fishing from any type of boat, canoe, or kayak; fishing from land or shore; boating recreationally; using a personal watercraft; and paddling recreationally). Additionally, we asked respondents to indicate level of agreement with a statement about awareness of laws and recommendations for slowing the spread of fish disease using a Likert scale with the response options *strongly disagree*, *disagree*, *neutral*, *agree*, and *strongly agree*. We also asked respondents to report their frequency of decontamination behaviors for slowing the transmission of fish disease using a Likert scale with the response options *never*, *sometimes*, *often*, *always*, and *not applicable*. The decontamination behaviors identified were draining live wells, bilges, and all water from a boat before leaving access sites; disinfecting live wells and bilges with a bleach solution; disposing of unused (live) fishing bait on the land or in the trash; power washing boats, paddling equipment, and trailers; and drying boats and paddling equipment for at least 5 days before launching in other waters.

After being exposed to one of the message frames, each participant was asked to express levels of agreement with statements regarding behavioral intentions related to seeking more information about how to reduce the spread of fish diseases, behavioral intentions related to following laws and recommendations for slowing the spread of fish diseases, and beliefs about risk to the natural environment and fisheries posed by fish diseases. Respondents replied using a 5-point Likert scale with response options ranging from *strongly disagree* to *strongly agree*. We asked the questions about behavioral intentions and beliefs only after message exposure in an effort to reduce social desirability bias (i.e., respondents' need to show individual improvement in responses relative to a before-message-exposure response; Lee et al., 2015). The survey instrument included sociodemographic questions about gender, birth year, level of education, 2015 household income, and city and state of residence. During the interviews, some participants stated that they did not know an answer or preferred not to answer regarding some of the items on the questionnaire.

### ANALYSIS

We calculated descriptive statistics to summarize the variables. "Don't know" and "prefer not to answer" responses were recoded as missing data for analyses. We used Kruskal-Wallis H tests due to the small sample size, which allow more than two independent groups to be tested on ordinal-scale dependent variables. There were five independent groups for hypothesis testing—one for each message. Other independent grouping variables used for other Kruskal-Wallis H tests were education level, 2015 household income level, and event attended. Mean ranks are compared in the Kruskal-Wallis H tests, meaning that higher values within the group are assigned higher ranks, and as *agree* and *strongly agree* are valued at 4 and 5, respectively, higher mean ranks correspond to higher positive responses. Mann-Whitney U tests were used as well for grouping variables that had only two categories—gender (male/female) and participation in the five aquatic-based recreational activities (yes/no). The dependent variables tested were as follows: intention to seek more information on reducing the spread of fish diseases, intention to follow laws and recommendations for slowing the spread of fish diseases, the belief that fish diseases pose a risk to fisheries and the natural environment (also known as risk perception), and the desire to learn more about MDNR Fisheries Division's fish disease management.

## RESULTS

We conducted 82 interviews; some respondents chose not to respond to some sociodemographic questions. Those who declined to participate in the study indicated that they did not have interest or time to participate. Respondent sociodemographic characteristics are presented in Table 1.

Sixty percent of respondents ($n = 49$) reported agreement that they were aware of the laws and recommendations to protect against fish diseases in Michigan. Figure 2 shows

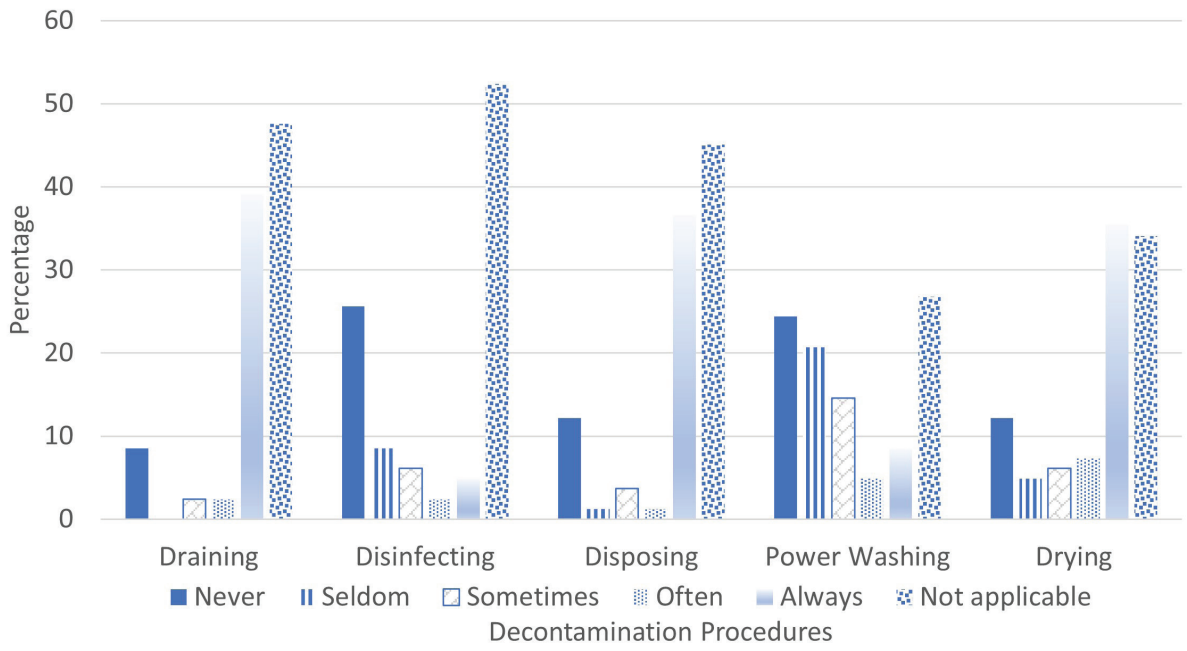



**Figure 2.** Reported decontamination practices, Michigan, 2016.

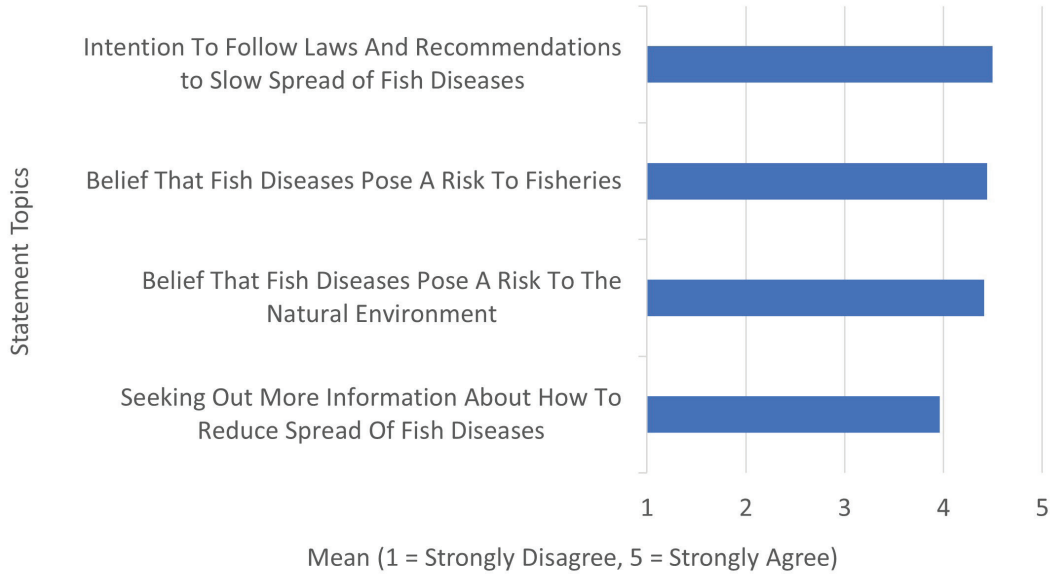



**Figure 3.** Agreement with intention and belief statements, Michigan, 2016.

**Table 1**. Fish Disease Communication Messages Survey Respondent Sociodemographics, Michigan, 2016

| Variable | # (%) | *M* (*SD*) |
|---|---|---|
| Gender | | |
| Female | 42 (51.0) | |
| Male | 40 (49.0) | |
| Age | | 54 years (12.42) |
| Education | | |
| Less than high school | 1 (1.2) | |
| High school diploma or GED | 10 (12.2) | |
| Some college or technical school | 21 (25.6) | |
| Associate's degree | 12 (14.6) | |
| College undergraduate degree | 21 (25.6) | |
| Graduate or professional degree | 17 (20.7) | |
| Income | | |
| $40,000 or less | 12 (14.6) | |
| $40,000–$60,000 | 13 (15.9) | |
| $60,000–$80,000 | 17 (20.7) | |
| $80,000–$100,000 | 7 (8.5) | |
| $100,000–$120,000 | 10 (12.2) | |
| $120,000 or more | 12 (14.6) | |
| No response | 11 (13.4) | |
| Interview location | | |
| Grand Rapids Boat Show | 23 (28.0) | |
| Michigan Outdoorama | 25 (30.5) | |
| Ultimate Sport Show | 9 (11.0) | |
| West Michigan Women's Expo | 25 (30.5) | |
| Residence | | |
| Michigan | 81 (99.0) | |
| Other | 1 (1.0) | |
| Recreational activity participation | | |
| Fishing from boats | 60 (73.0) | |
| Fishing from land/shore | 64 (78.0) | |
| General recreation with boats | 64 (78.0) | |
| Personal watercraft activity | 12 (15.0) | |
| Recreational paddling activity | 50 (61.0) | |

reported levels of adherence to decontamination practices, and Figure 3 shows levels of agreement with intention and belief statements.

Socioeconomic variables such as education and income, as well as the event location, were not significant relative to respondents' intentions and beliefs (Table 2). Differences in communication frame effect were detected at $p < .10$ for intention to seek more information about reducing the spread of fish diseases ($p = .078$) and to follow laws and recommendations for slowing the spread of fish disease ($p = .055$) (Table 2).

In a fish disease context, the gain frame had the higher mean rank for seeking more information about reducing the spread of fish diseases (47.65), intention to follow laws and recommendations for slowing the spread of fish diseases (49.59), and wanting to learn more about MDNR Fisheries Division's fish disease management (50.09; Table 3). In the fish disease management context, the loss frame had the

**Table 2**. Kruskal-Wallis H Test Results, Michigan 2016

| Grouping variable | *df* | I will seek out more information about how I can reduce the spread of fish diseases. | | I intend to follow the laws and recommendations to slow the spread of fish diseases. | | I believe fish diseases pose a risk to fisheries. | | I believe fish diseases pose a risk to the natural environment. | | I want to learn more about MDNR Fisheries Division's fish disease management. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $X^2$ | *p* | $X^2$ | *p* | $X^2$ | *p* | $X^2$ | *p* | $X^2$ | *p* |
| Communication frame | 4 | 8.391 | .078* | 9.256 | .055* | 2.228 | .694 | 2.428 | .658 | 6.343 | .175 |
| Education | 5 | 1.189 | .946 | 6.621 | .250 | 8.063 | .153 | 5.633 | .344 | 4.604 | .466 |
| Income | 5 | 5.085 | .406 | 5.548 | .353 | 7.882 | .163 | 3.540 | .617 | 3.551 | .616 |
| Event | 3 | 5.206 | .157 | 5.837 | .120 | 4.587 | .205 | 4.669 | .198 | 2.101 | .552 |

*Note*. $p < 10$.

**Table 3**. Mean Ranks of Kruskal-Wallis H Tests for Response Variables by Communication Frame, Michigan, 2016

| Variable | Fish disease | | Control | Fish disease mgmt. | | Total no. of respondents |
|---|---|---|---|---|---|---|
| | Gain Mean rank | Loss Mean rank | Mean rank | Loss Mean rank | Gain Mean rank | |
| Intention to seek more information to reduce the spread of fish diseases | 47.65 (*n* = 17) | 44.97 (*n* = 17) | 43.59 (*n* = 16) | 43.09 (*n* = 16) | 27.59 (*n* = 16) | 82 |
| Intention to follow the laws and recommendations to slow the spread of fish diseases | 49.59 (*n* = 17) | 43.78 (*n* = 16) | 41.25 (*n* = 16) | 41.25 (*n* = 16) | 28.59 (*n* = 16) | 81 |
| Belief that fish diseases pose a risk to fisheries | 43.41 (*n* = 17) | 37.53 (*n* = 17) | 41.00 (*n* = 16) | 47.13 (*n* = 16) | 38.56 (*n* = 16) | 82 |
| Belief that fish diseases pose a risk to natural environment | 39.91 (*n* = 17) | 39.50 (*n* = 15) | 39.84 (*n* = 16) | 47.06 (*n* = 16) | 36.16 (*n* = 16) | 80 |
| Desire to learn more about MDNR Fisheries Division's fish disease management | 50.09 (*n* = 17) | 43.41 (*n* = 17) | 42.97 (*n* = 16) | 38.75 (*n* = 16) | 31.63 (*n* = 16) | 82 |

*Note*. MDNR = Michigan Department of Natural Resources.

higher mean rank for belief that fish diseases pose a risk to fisheries (47.13), belief that fish diseases pose a risk to natural environment (47.06), and desire to learn more about MDNR Fisheries Division's fish disease management (38.75; Table 3).

Respondents were also asked about their participation in various aquatic activities. Fishing activities, from a boat, canoe, or kayak or from land or shore, or were more influential variables for seeking more information about how to reduce the spread of fish diseases than were nonfishing activities (Table 4). Participation in recreational boating or paddling was not significant for seeking more information about how to reduce the spread of fish diseases or intending to follow laws and recommendations for slowing the spread of fish diseases (Table 4). Gender was not a significant variable for respondents' intentions and beliefs related to fish disease (Table 4).

## DISCUSSION

Although our study was conducted in Michigan, the findings are applicable to outreach programs across the United States that address practices that prevent the spread of fish diseases, including draining equipment, disinfecting live wells and bilges, and disposing of live bait. From our findings, we made the following determinations: (a) for increasing risk perceptions regarding fish diseases, a loss frame in a fish disease management context should be used; (b) for decreasing risk perceptions regarding fish disease

**Table 4**. Mann-Whitney U Test p-Value Results, Michigan, 2016

| Grouping variable | I will seek out more information about how I can reduce the spread of fish diseases. | I intend to follow the laws and recommendations to slow the spread of fish diseases. | I believe fish diseases pose a risk to fisheries. | I believe fish diseases pose a risk to the natural environment. | I want to learn more about MDNR Fisheries Division's fish disease management. |
|---|---|---|---|---|---|
| Gender | .433 | .226 | .214 | .495 | .671 |
| Fishing from boat, canoe, or kayak | .012[b] | .946 | .739 | .490 | .501 |
| Fishing from land or shore | .055[a] | .316 | .394 | .388 | .153 |
| Recreational boating | .294 | .953 | .707 | .518 | .917 |
| Recreational paddling | .930 | .205 | .323 | .490 | .748 |

*Note*. MDNR = Michigan Department of Natural Resources.
[a] Significant at level α = 0.10. [b] Significant at level α = 0.05.

management, a gain frame in a fish disease context should be used; (c) for motivating behavioral intentions regarding prevention and risk reduction, a gain frame in a fish disease context should be used. More specifically, if the conservation goal is to increase perceptions of risk of a potential fish disease to fisheries and the environment, using a loss frame within the context of disease management is recommended, as this frame resulted in the higher mean ranks for beliefs that fish diseases pose a risk to fisheries and the natural environment. This frame may also be appropriate in contexts where a disease is not present yet or detected because of organism type (O'Malia et al., 2018). And if the goal is to motivate intention to engage in risk-reducing, preventative behaviors related to fish disease, using a gain frame in a disease context is recommended.

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