

# Incorporating Social Science Theories in Fisheries Research: The Case of FADS in the Caribbean Region

## Incorporando Teorías de las Ciencias Sociales en Estudios de Pesca: El Caso del Uso de Dispositivos de Agregación de Peces en la Región del Caribe

### Incorporer les Théories des Sciences Sociales dans les Études de Pêche: Le Cas de l'Utilisation de Dispositifs d'Agrégation des Poissons dans la Région des Caraïbes

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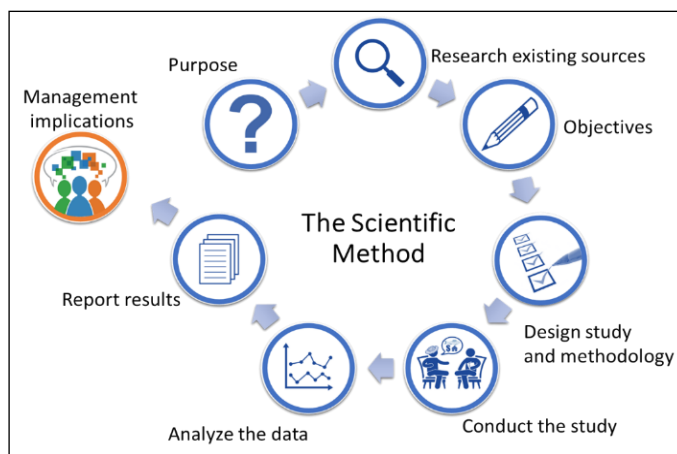
#### EXTENDED ABSTRACT

Recently, fisheries managers, stakeholders, and researchers have acknowledged the importance of combining systematic research in the natural world (e.g., fish population parameters, oceanographic conditions, fish catch per unit effort, etc.) with research related with human behavior (termed as “social sciences”) for natural resource management and conservation. In the scientific literature, there are several examples of the use of social science to understand the attitudes and beliefs of target populations. This constitutes a critical step when developing practical educational and outreach programs and identifying management actions to deter or promote a desired behavior or action.

There is a need to provide training opportunities to managers and stakeholders regarding the methodological steps to implement social science in support of resource management contexts. Therefore, in this paper, we present an example of the incorporation of a well-known social science theory (the theory of planned behavior -TPB) to understand what motivates/deters the installation of fish aggregating devices by Caribbean artisanal fishers. By focusing this paper on the operational steps, we hope to assist in the implementation of social science theory in future research that promotes a greater understanding of human behavior related with environmental issues in the Caribbean region.

Science can be defined as a systematic and organized body of knowledge in any area of inquiry that utilizes “the scientific method.” In the case of social science, researchers focus on people’s behaviors and perceptions (individual or collective).

The scientific method refers to a standardized set of procedures or guidelines for building knowledge. The steps followed in our case study are summarized in Figure 1 and described in the rest of this paper.



**Figure 1.** The scientific method

#### Define a Question

Usually the research question arises as a need to enlighten a specific problem. In our study case, we needed to understand what factors promote or deter fishers from setting private fish aggregation devices (FADs). FADs are being used in the Caribbean region as a tool to increase capture of pelagic fishes. Usually, they are moored structures that float in the ocean. Because fish are attracted to them, they provide fishers with a known location of fish schools, which may increase fishing efficiency and profitability. Based on ownership and access in the Caribbean region there are private FADs, which are set by individuals or small groups and are usually hidden from other fishers, and public fads, which are deployed by the government and are open access but may require a license (Sidman et al. 2012).

### Research Existing Sources of Information

The objective of this activity was to familiarize ourselves with research that has been conducted on this topic not only in the Caribbean region but also worldwide. We were particularly interested in evaluating the methodology used in similar previous analyses.

We determined that most of the social science research done in the Caribbean region consisted of characterizations with little to no reference to social science theories. By contrast, we evaluated the use and applicability of various social science theories to guide our research.

We used the theory of planned behavior (TPB) as a framework for our study. This theory has been used by others to guide education and communication outreach strategies with the purpose of modifying people's behavior (i.e., smoking, reckless driving, poaching, hunting, etc.). The theory establishes that a behavior is most likely to occur if the person has a positive attitude towards it, if there is a belief that other people are engaging in the behavior or that others want you to engage in the behavior, and if people think that they have the skills, knowledge, equipment, and capacity to perform the behavior. The TPB also assumes that intention is an immediate precursor of exhibiting a behavior: when the opportunity arises, people are expected to perform their intentions.

One example of the use of this theory to guide outreach strategies is an education campaign conducted in Florida to promote compliance with speed zones to protect manatees. A study conducted by University of Florida researchers (Jett et al. 2013) showed that messages appealing not only to the users' attitudes but also to social norms (desires of family members, other boaters and law enforcement officers) might be more effective to promote compliance. In the medical field, there are several examples of the use of this theory to modify behaviors such as smoking, weight loss, drug addiction, among others.

### Define Objective (s)

Objectives should be clearly defined and delimited to the unit of study. The case study's objective was to examine the roles of attitude, social norm (SN), and perceived behavioral control as predictors of intention to set private FADs in the Caribbean region. Our unit of interest were fishers in the Caribbean region that are setting their own FADs to catch pelagic fish.

### Design Study and Methodology

We solicited information from artisanal fishers in five countries in the Lesser Antilles (Antigua and Barbuda, Dominica, St. Lucia, St. Vincent and the Grenadines, and Grenada) using structured interviews.

The TPB was used as a framework to construct the survey instrument. Most of the items used to measure each of the TPB constructs (attitude, social norm, and perceived behavioral control) were questions modified from the literature. A construct is an abstract concept that explains a given phenomenon (for instance, attitude). Usually, to measure constructs researchers use more than one item or question to produce an index of the construct (at least four items per construct). Furthermore, because we want to be able to measure the strength of each construct in relation

with the behavioral intention (setting private FADs) we used a five-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree).

### Conduct the Study

The study questionnaire was pilot tested by fisheries officers representing the participating countries. Questionnaire (i.e., item wording, survey length) and methodology (i.e., sampling procedure) were adjusted based on recommendations from the pilot test. Data collection was conducted during September-November 2016. Individual interviews took about 40 minutes to complete and they were conducted at randomly selected landing sites on each participating island. Within landing sites, surveyors solicited fishers' participation by convenience sampling. This technique allowed us to maximize our sample by surveying a number of fishers who happened to be present at landing sites during optimal periods, without having to conduct a more time-consuming random sampling option. Surveyors were also responsible for uploading completed survey data into an online survey service (Qualtrics). This allows principal researchers to have access to the data via the internet within one or two days of data collection. Participation of fisheries division officers on each island nation proved to be crucial to the success of the project, especially during the survey design, protocol testing, and data collection phases.

### Analyze the Data

First, we inspected the data and identified incomplete surveys (missing most of the records), which were eliminated from the analysis. We also evaluated questions nonresponse rates. In our study, question nonresponse was low (Roth 1994). General statistical analyses (including mean, standard deviation, chi square) were used to generate respondent profiles. Because we used several survey items (questions) as input to measure each of the three TPB constructs it was important to conduct two kinds of tests. An internal consistency test first measured the correlation of each item with respect to other items used to develop indices for each TPB construct. For example, we expected that respondents with a positive attitude toward the behavior of setting FADs held this perception even when asked about it in different ways, such as reverse questions. A common test used in the literature to evaluate the consistency of answers to similar questions is Cronbach's alpha coefficient (Gliem and Gliem 2003) (Table 1).

A second test grouped the items and associated these groupings (depicted as factors in Table 2) with the most related TPB construct. For example, we wanted to clarify if items developed to measure a specific construct (e.g., social norm) are internally consistent (really measuring that particular construct) or if the items might also be associated with another construct (e.g., attitude). An analysis of variable consistency with TPB constructs was evaluated using principal component analysis (PCA) (Vaske 2008).

We used structural equation modeling (SEM) in Mplus 8.0 (Muthén and Muthén 1998 - 2011) to measure the strength and direction of the relationship of each TPB construct with fishers' intentions to set private FADs. Model fit can be assessed using standard methods: root

mean square error of approximation and comparative fit index (Browne and Cudeck 1992, McDonald and Marsh 1990).

**Table 1.** Items used based on Cronbach's alpha.

	Mean	St. Deviation	Cronbach's alpha
<b>ATTITUDE</b>			
Setting and/or maintaining a private FAD takes a lot of time.	2.3	1.0	0.75
Private FADs are difficult to set and/or maintain.	2.7	1.1	
Private FADs are expensive to set and/or maintain.	2.2	0.9	
Private FADs are quickly lost.	2.6	1.1	
Private FADs attract too many fishermen.	2.7	1.1	
<b>SOCIAL NORM</b>			
Most of my friends set and/or maintain private FADs.	2.8	1.1	0.83
Most of my friends think I should set and/or maintain private FADs.	2.9	1.0	
Most fishers set and/or maintain private FADs.	2.6	1.1	
Other fishers expect me to set and/or maintain private FADs.	2.8	1.0	
Fisheries managers expect me to set and/or maintain private FADs.	2.4	0.9	
Other fishermen support the setting and/or maintaining of private FADs.	3.1	1.1	
<b>PERCEIVED BEHAVIORAL CONTROL</b>			
I am confident in my ability to set and/or maintain private FADs.	3.53	1.1	0.50*
I do not know how to set and/or maintain private FADs.	3.52	1.1	
Whether or not I set and/or maintain private FADs is entirely up to me.	3.66	0.9	

\* the statistical threshold (Cronbach's alpha  $\geq$  0.7) was not meet for the perceived behavioral control items.

**Table 2.** Principal component analysis results showing relevant associations of items with TPB constructs.

	Factor Loadings		
	1	2	3
<b>ATTITUDE</b>			
Setting and/or maintaining a private FAD takes a lot of time.	0.81		
Private FADs are difficult to set and/or maintain.	0.76		
Private FADs are expensive to set and/or maintain.	0.74		
Private FADs are quickly lost.	0.67		
Private FADs attract too many fishermen.	0.46		
<b>SOCIAL NORM</b>			
Most of my friends set and/or maintain private FADs.		0.78	
Most of my friends think I should set and/or maintain private FADs.		0.76	
Most fishers set and/or maintain private FADs.		0.70	
Other fishers expect me to set and/or maintain private FADs.		0.75	
Fisheries managers expect me to set and/or maintain private FADs.		0.65	
Other fishermen support the setting and/or maintaining of private FADs.		0.60	
<b>PERCEIVED BEHAVIORAL CONTROL</b>			
I am confident in my ability to set and/or maintain private FADs.			0.77
I do not know how to set and/or maintain private FADs.			0.70
Whether or not I set and/or maintain private FADs is entirely up to me.			0.60

**Report Results**

Fishers' intention to set private FADs was related with social norms ( $r = 0.17, p < 0.05$ ) and perceived behavioral control ( $r = 0.5, p < 0.05$ ). Attitude was not a significant factor regarding the intent to set private FADs. The model was able to explain 40% of the total variation in our dataset. Model fit estimates remained within acceptable values (RMSEA = 0.067 [0.060 - 0.073], CFI = 0.89, TLI = 0.84, and WRMR = 1.1).

**Management Implications**

We found that fishers are more likely to set private FADs if:

- i) They think that others are setting private FADs. Therefore, if the desire is to establish a program based on public FADs (FADs that are open to everybody), government assistance should be oriented toward helping fishers to set public FADs and communication messages and outreach programs should incorporate social marketing strategies that instill a preference among fishers for setting public FADs. A corroborating finding

from the study is that the number of fishers who participated in public FAD deployments increased by 29% over the last 5 years.

- ii) They think that they have the capacity (skills and financial resources) to set private FADs. Therefore, we suggest that it is important for government to continue to support public FAD programs and co-management strategies to maintain public FAD programs in the longer-term.

KEYWORDS: Human behavior, FADs, governance

**LITERATURE CITED**

Bhattacharjee, A. 2012. *Social Science Research: Principles, Methods, and Practices. Textbooks Collection. 3.* [http://scholarcommons.usf.edu/oa\\_textbooks/3](http://scholarcommons.usf.edu/oa_textbooks/3).

Browne, M.W. and R. Cudeck. 1993. Alternative ways of assessing model fit. Pages 136 - 162 in: . A. Bollen and J. S. Long (Eds.) *Testing Structural Equation Models.* Sage, Newbury Park, California USA.

Gliem, J.A. and R.R. Gliem 2003. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. *Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education,* Ohio State University, Columbus, Ohio USA.

Jett, J., B. Thapa, and R. Swett 2013. Boater speed compliance in manatee zones: examining a proposed predictive model. *Society & Natural Resources* 26(1):95 - 104.

McDonald, R.P. and H.N. Marsh. 1990. Choosing a multivariate model: Noncentrality and goodness of fit. *Psychological Bulletin* 107:247 - 255.

Muthén, L.K. and B.O. Muthén. 1998–2011. Mplus User's Guide. 6th Edition. Muthén & Muthén, Los Angeles, California USA.

Roth, P.L. 1994. Missing data: A conceptual review for applied psychologists. *Personnel Psychology* 47(3):537 - 560.

Sidman, C., K. Lorenzen, R. Sebastien, A. Magloire, J. Cruickshank-Howard, J. Hazell, and J. Masters. 2014. *Toward a Sustainable Caribbean FAD Fishery: An Analysis of Use, Profitability, and Shared Governance.* Florida Sea Grant Technical Paper 206. University of Florida, Gainesville, Florida USA.

Vaske, J.J. 2008. *Survey Research and Analysis: Applications in Parks, Recreation, and Human Dimensions.* Venture Publishing, State College, Pennsylvania USA. 658 pp.