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Development of a scale to measure the perception of stakeholders towards marine fisheries governance: A methodological approach from a case study in Andhra Pradesh

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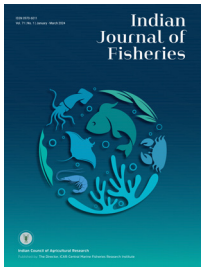

Abstract

This study aims at development of a psychological scale to measure the perception of stakeholders towards the Andhra Pradesh Marine Fisheries Regulation Act (APMFRA). The collection of items included 31 statements covering the dimensions such as zonation, registration, licensing, monitoring, implementation, conservation related fishing regulations, penalty structures and effectiveness. The 31 statements were evaluated by a group of 34 judges representing research, education and extension in the field of fisheries and social sciences, through which 18 statements were selected with relevancy percentage of more than 61%, and mean relevancy score of more than 1.85. Through t-test item analysis, the final perception scale was constructed with 10 statements with t value of more than 1.75, out of the 18 statements. The scale has demonstrated both reliability and validity, confirming its consistency and accuracy in measuring perceptions of APMFRA. The administration of the scale among the stakeholders would elicit their perception towards the Act, and the areas to be strengthened for effective fisheries governance such as the regulations which are to be strengthened with the incorporation of scientific advisories, technological measures and conflict resolution mechanisms.

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Introduction

Similar to other resource-based activities, fisheries management takes place in complex, contingent and uncertain circumstances. Scientific advice for fisheries is expected to support policymaking processes, and the need to minimise risks in contexts with high uncertainty has led to the establishment of the preference among policymakers for indicators based on quantitative modelling that helps to simplify and to objectify decision-making processes (Rodrigues *et al.,* 2021). The implementation of fisheries regulations is often hindered by a lack of consistent definitions for key concepts among professionals, particularly administrators, as noted by Weiand *et al.* (2021). To bridge this gap, strong interaction and shared understanding between stakeholders are crucial for effective governance. This, in turn, is vital to enable and sustain increased participation of various groups in making choices, and stakeholder engagement is always seen as a critical component of managing fisheries. Robust and comprehensive governance frameworks for fisheries and natural assets are a widely accepted prerequisite for efficient oversight and sustainability. The establishment of effective policies often involves a blend of local, national, and international cooperation, integrating scientific advice, stakeholder engagement, and adaptive management principles to

ensure long-term resource viability (Potts *et al.*, 2020). Armitage *et al.* (2007) suggested that "'adaptive co-management" may represent an important innovation in natural resource governance under conditions of change, uncertainty, and complexity'. Complexity and uncertainty are identified as key concerns contributing to the rationale for an adaptive approach to governance and management of natural resources, as confirmed by Fennell *et al.* (2008). For the purpose of efficient and equitable management, it is imperative to ascertain the opinions and principles that groups of fishermen have on their means of subsistence and lifestyle. Through an organisational structure, involving relationships among multiple social actors, lawmakers can better develop systems of governance that are accepted, valued, and upheld by societies by taking these values into account (Knoke, 2019). Data of this type can also show how fishing regulations are regarded to be working. These opinions are significant because they could affect adherence to the rules that make up the governance system.

The capture fisheries sector in India has undergone rapid expansion, primarily driven by mechanised fishing methods. This growth has led to overcapitalisation and several associated crises, including declining catch rates, overfishing, and environmental degradation resulting from high-intensity trawling (Devaraj and Vivekanandan, 1999; Ramachandran, 2004). These challenges have frequently led to disputes among fishermen and vessel operators, highlighting the need for a more effective regulatory framework to manage maritime resources. The Marine Products Export Development Authority Act of 1972 (Act No. 13 of 1972) mandates the registration of fishing vessels and adherence to marine regulations to support the development of the marine products industry. At the state level, Andhra Pradesh regulates fishing through the Andhra Pradesh Marine Fisheries Regulation Act (APMFRA) of 1995. This Act governs mechanised and motorised fishing, imposing specific restrictions on vessel size and proximity to the shore to protect coastal ecosystems. With 1,50,868 active fishermen and 31,741 fishing crafts, the marine fisheries sector is an important source of employment and income generation in the State. The marine fisheries of the State is vulnerable to external influences namely, overexploitation of marine resources, environmental degradation and climate change. Thus this sector deserves to be nurtured and managed effectively keeping in mind the challenges faced by the sector (Muktha *et al.,* 2018).

Despite the presence of fisheries regulations for over a century, evolving challenges necessitate a comprehensive reassessment of the existing framework (Shinoj and Ramachandran, 2018). Although the Seasonal Fishing Ban (SFB) has been a valuable regulatory tool, it's effectiveness could be improved by integrating additional measures (Narayanakumar *et al.,* 2017). Nevertheless, issues such as inadequate institutional commitment and poor enforcement have significantly undermined the effectiveness of these regulations (Shinoj and Ramachandran, 2017). To address these concerns and enhance implementation and compliance, there is a critical need to develop a scale for evaluating the perception of the key stakeholders *viz.,* researchers, extension personnel and fishers towards the APMFRA. In this context, this study was taken up in 2022-2023, aiming at development of a scale to measure the perception of the stakeholders towards the Andhra Pradesh Marine Fisheries Regulation Act (APMFRA) covering the aspects of registration, licensing, regulations, monitoring, conservation, and penalty structures under the Act.

Materials and methods

Perception is the organization, identification, and interpretation of sensory information, in order to represent and understand the presented information or environment (Schacter *et al,*, 2011). Social perception is the part of perception that allows people to understand the individuals and groups of their social world. Thus, it is an element of social cognition (Smith and Mackie, 2000). Perception is mental organization and interpretation of sensory information. It is the opinion expressed by the respondents (Argade *et al.,* 2015). A well-constructed perception scale consists of a number of items that have been just as carefully edited and selected in accordance with certain criteria, as the items contained in any standardised psychological test. The items making up a psychological scale are called 'statements'. A statement may be defined as anything that is said about a psychological object (Edwards and Kilpatrick, 1948).

In the present study, perception was operationalised as particular way of looking at or understanding something, an opinion, and the respondents' degree of favourableness or unfavourableness towards the regulations of marine fisheries governance in Andhra Pradesh. On the basis of the review of literature and discussion with the subject matter specialists, the following dimensions were identified for easy classification and measuring the perceptions of APMFRA on regulation of fishing, registration of fishing vessels, licensing of fishing vessel, monthly reporting and information submission, conservation related restrictions on fishing and penalty structures.

Construction of perception scale

In the present study, the method suggested by Likert (1932) in developing summated rating scale was followed for constructing the perception scale. In this scale, each item was judged on a five-point continuum. The scale was developed by adopting the following stages *viz.,* collection of items, relevancy test, item analysis for selection of statements, reliability of the scale, validity of the scale and method of scoring.

Collection of items

The first step in constructing a psychological scale is to gather relevant items, *i.e.*, statements that represent the universe of content of the study. Rigorous and strenuous exercise was made to collect the items through exhaustive review of literature pertaining to the subject under study and in consultation with subject matter specialists, ensuring that they reflect the diverse components of stakeholder perceptions towards marine fisheries governance. These statements were carefully curated to ensure that they were relevant and representative of the research objectives. The identified statements were carefully edited, following the fourteen

informal criteria suggested by Edwards and Kilpatrick (1948). Care was taken to include approximately equal number of positive and negative statements. As a result, 31 statements were selected reflecting on the themes of the Act towards marine fisheries governance.

Relevancy test

The identified statements were subjected to scrutiny by a panel of experts to determine the relevancy of items. The set of statements were mailed to 40 judges representing research, education and extension in the field of fisheries and social sciences, for critical evaluation of items for their relevancy for measuring the perception towards marine fisheries governance in Andhra Pradesh. The judges were asked to give their response on a four-point continuum, most relevant, relevant, least relevant and not relevant and they were also asked to make necessary modifications deemed fit. The scoring pattern of 3, 2, 1 and zero was followed for the responses *viz.*, most relevant, relevant, least relevant and not relevant respectively. The responses were received in time from 34 judges for further processing. The relevancy score for each item was calculated by summing up the ratings assigned by all judges and subsequently expressed as the relevancy percentage and mean relevancy score.

The actual score (AS) for each statement was calculated by summing the scores given by all judges. The total score (TS) was the maximum possible score, which was obtained by multiplying the number of judges by 3 (the highest score on the scale). The relevancy percentage was then calculated for each statement using the formula:

$$\text{Relevancy \%} = \frac{\text{Actual Score}}{\text{Total Score}} \times 100$$

where, Actual score = Sum of the score of judges on the item;
Total score = Sum of highest possible score

The mean relevancy score (MRS) was also computed by dividing the Actual Score by the number of judges. Statements with a relevancy percentage of more than 61% and a mean relevancy score above 1.85 were considered highly relevant and selected for further item analysis (Table 1).

Item analysis for selection of statements

Item analysis was conducted to assess how efficiently each item discriminated between individuals with differing levels of perception. Researchers, extension personnel and fishers were given the set of selected 18 statements for item analysis. The responses were obtained on a five-point continuum of Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree with a score of 5, 4, 3, 2, and 1 for positive statements and reverse scoring (1, 2, 3, 4, and 5) for negative statements, respectively. The perception score for each individual on the scale was computed by summing up the scores of all the items. For the purpose of evaluating the statements, the respondents were arranged in ascending order based on individual attitude scores. Criterion groups were formed by selecting the lower 25% and the upper 25% of the respondents based on these scores.

The 't' value was computed using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\Sigma(X_H - \bar{X}_H)^2 + \Sigma(X_L - \bar{X}_L)^2}{n\,(n-1)}}}$$

where, $\Sigma(X_H - \bar{X}_H)^2 = \Sigma X_H^2 - (\Sigma X_H)^2/n$
and $\Sigma(X_L - \bar{X}_L)^2 = \Sigma X_L^2 - (\Sigma X_L)^2/n$

where,

$\bar{X}_H$ = Mean score on a given statement for the high group

$\bar{X}_L$ = Mean score on a given statement for the low group

ΣX^2_H = Sum of squares of the individual scores on a given statement for high group

ΣX^2_L = Sum of squares of the individual scores on a given statement for low group

ΣX_H =Sum of scores on a given statement for high group

ΣX_L = Sum of scores on a given statement for low group

n= Number of respondents in each group

The 't' value is a measure of the extent to which a given item differentiates the high group from low group.

Results and discussion

Statements with a relevancy percentage of more than 61% and a mean relevancy score above 1.85 were considered most relevant and selected for further item analysis. Based on the relevancy test results, 18 statements were selected for the item analysis (Table 2) .

Based on item analysis after computing the 't' values for the 18 items (Table 2), ten items with good discriminating values ('t' value of more than 1.75) were retained in the final scale which consists of five positive statements and five negative statements (Table 3) to measure the perceptions of the stakeholders.

Reliability of the scale

According to Kerlinger (1995), 'reliability is the ability of the measuring instrument to yield consistent results when applied to the same sample'. Reliability was measured by employing test-retest method. The test was conducted with 30 respondents. After first administration, the scores of each respondent were calculated. The test was re-administered after 30 days with the same sample respondents and the scores were worked out. The 'r' value was 0.87 and the reliability value was found significant at 0.01 level of probability indicating high reliability of the scale.

Validity of the scale

According to Kerlinger (1995), 'validity is the ability of the measuring instrument to measure, what it is purported to measure'. Validity was

Table 1. List of items for perception scale towards APMFRA and their relevancy weightages

Sl.No.	Items	Actual score	Total score	Relevancy %	Mean relevancy score
1	APMFRA is strong enough to address the challenges faced by the marine fisheries sector of Andhra Pradesh.	99	102	97.06	2.91
2	APMFRA is not reviewed and updated periodically in response to the emerging issues of marine fisheries sector of Andhra Pradesh.	98	102	96.08	2.88
3	The scientific advisories from the marine fisheries research institutions are finding place in the APMFRA.	93	102	91.18	2.73
4	APMFRA fails to protect the needs of fishers, scientific regulation of fishing and maintenance of law and order in the sea.	90	102	88.23	2.65
5	APMFRA is monitored and implemented strictly by the implementation agency.	89	102	87.25	2.62
6	The stakeholders' access to the information on marine fisheries regulations and subsequent amendments under APMFRA is very poor.	86	102	84.31	2.53
7	The mandatory trawl requirements such as Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) are not given adequate emphasis in APMFRA.	81	102	79.41	2.38
8	The cost structures for registration and licencing of fishing vessels, and the penalty structures for non-compliance under APMFRA are reasonable and justifiable.	78	102	76.47	2.29
9	Adequate communication mechanisms are in place to create awareness among the stakeholders on the various regulations and amendments under APMFRA.	76	102	74.51	2.23
10	Adequate conflict resolution mechanism is not in place under APMFRA for enabling better management of conflicts in the marine fisheries sector.	76	102	74.51	2.23
11	APMFRA gives adequate emphasis regarding vessel movement information, catch log book maintenance, species catch details, which need to be made available to the authorities.	73	102	71.57	2.15
12	APMFRA regulations are not monitored distinctly for licensing of mechanised and motorised fishing crafts.	70	102	68.63	2.06
13	APMFRA does not give adequate focus on implementing area-specific trawl restrictions, such as depth limitations, which is a crucial step in preventing damage to sensitive benthic habitats and associated resources.	70	102	68.63	2.06
14	APMFRA regulations are not monitored strictly, especially with respect to the parameters such as the optimum number of fishing vessels and sustainable fishing practices in the State.	67	102	65.69	1.97
15	APMFRA is efficient in addressing the issues related with ring seine fishery.	67	102	65.69	1.97
16	APMFRA gives adequate focus on no-trawl zones during critical breeding seasons, which is a crucial step in ensuring responsible and sustainable fishing practices.	66	102	64.70	1.94
17	Implementation of the APMFRA fails to guarantee the utilisation of appropriate assessment methods for accurately determining the status of fish stocks.	65	102	63.72	1.91
18	The APMFRA is believed to be adequate in addressing the present level of exploitation, juvenile fishing, bycatch, and IUU fishing.	63	102	61.76	1.85
19	No vessel, other than a registered fishing vessel, is entitled to a license under APMFRA emphasizes the importance of fishing vessel registration for obtaining a license.	62	102	60.78	1.82
20	I perceive that, audits and inspections serve as an effective monitoring tool to assess whether fishing activities are conducted within the legal framework and adhere to sustainable fishing practices, wherein the APMFRA fail to give emphasis for the same.	59	102	57.84	1.73
21	The APMFRA does not give adequate emphasis for mandatory gear designs such as escape panels, which is an essential step in minimizing by-catches and non-target species.	57	102	55.88	1.68
22	Non-compliance of APFMRA can have negative implications for the sustainability of marine resources of the State.	57	102	55.88	1.68
23	The APMFRA regulations are not giving priorities to food security of the people.	57	102	55.88	1.68
24	The APMFRA is efficient, adequate and meaningful in addressing the ecosystem-based concerns.	57	102	55.88	1.68
25	Seasonal fishing ban is the only regulation under APMFRA, efficiently monitored and implemented in the State.	57	102	55.88	1.68
26	Registration and licensing of fishing vessels are not important regulations of APFMRA for determining the optimum size of fishing fleet.	56	102	54.90	1.65
27	Enforcement of marine fisheries regulations prescribed in APMFRA are very poor, which lead to over exploitation of marine resources.	55	102	53.92	1.62
28	The APMFRA regulations are adequate to address the challenges pertaining to ecological needs and marine ecosystems.	55	102	53.92	1.62
29	The APMFRA does not give any framework for facilitating the fishing community organizations to represent their rights and engage in a dialogue with the State.	55	102	53.92	1.62
30	The APMFRA ensures transparency in governance for achieving sustainable food system.	51	102	50.00	1.50
31	The APMFRA facilitates rational exploitation of the state's fishery resources in a sustainable manner.	51	102	50.00	1.50

Table 2. Perception towards APMFRA: List of items selected after relevancy test and their 't' values

Sl.No.	Items	Actual score	Total score	Relevancy %	Mean Relevancy score	t value
1	APMFRA is strong enough to address the challenges faced by the marine fisheries sector of Andhra Pradesh.	99	102	97.06	2.91	2.238
2	APMFRA is not reviewed and updated periodically in response to the emerging issues of marine fisheries sector of Andhra Pradesh.	98	102	96.08	2.88	2.211
3	The scientific advisories from the marine fisheries research institutions are finding place in the APMFRA.	93	102	91.18	2.73	2.103
4	APMFRA fails to protect the needs of fishers, scientific regulation of fishing and maintenance of law and order in the sea.	90	102	88.23	2.65	1.983
5	APMFRA is monitored and implemented strictly by the implementation agency.	89	102	87.25	2.62	1.946
6	The stakeholders' access to the information on marine fisheries regulations and subsequent amendments under APMFRA is very poor.	86	102	84.31	2.53	1.857
7	The mandatory trawl requirements such as Turtle Excluder Devices (TEDs) and By-catch Reduction Devices (BRDs) are not given adequate emphasis in APMFRA.	81	102	79.41	2.38	1.838
8	The cost structures for registration and licencing of fishing vessels, and the penalty structures for non-compliance under APMFRA are reasonable and justifiable.	78	102	76.47	2.29	1.783
9	Adequate communication mechanisms are in place to create awareness among the stakeholders on the various regulations and amendments under APMFRA.	76	102	74.51	2.23	1.759
10	Adequate conflict resolution mechanism is not in place under APMFRA for enabling better management of conflicts in the marine fisheries sector.	76	102	74.51	2.23	1.834
11	APMFRA gives adequate emphasis regarding vessel movement information, catch log book maintenance, species catch details, which need to be made available to the authorities.	73	102	71.57	2.15	1.528
12	APMFRA regulations are not monitored distinctly for licensing of mechanized and motorised fishing crafts.	70	102	68.63	2.06	1.543
13	APMFRA does not give adequate focus on implementing area-specific trawl restrictions, such as depth limitations, which is a crucial step in preventing damage to sensitive benthic habitats and associated resources.	70	102	68.63	2.06	1.235
14	APMFRA regulations are not strictly monitored, especially with respect to the parameters such as the optimum number of fishing vessels and sustainable fishing practices in the State.	67	102	65.69	1.97	1.018
15	APMFRA is efficient in addressing the issues related with ring seine fishery.	67	102	65.69	1.97	1.358
16	APMFRA gives adequate focus on no-trawl zones during critical breeding seasons, which is a crucial step in ensuring responsible and sustainable fishing practices.	66	102	64.70	1.94	1.023
17	Implementation of the APMFRA fails to guarantee the utilisation of appropriate assessment methods for accurately determining the status of fish stocks.	65	102	63.72	1.91	0.987
18	APMFRA is believed to be adequate in addressing the present level of exploitation, juvenile fishing, bycatch, and IUU fishing.	63	102	61.76	1.85	0.993

measured through content validity. Content validity is to ensure whether each item and dimension of items as a whole measure what it is supposed to measure, and how well the scale contents represent the intended subject matter of study. Due care was taken in selecting the statements so as to cover the 'universe of content' of all relevant aspects of perception towards marine fisheries governance through discussions with experts and relevant literature on the subject. The scale, thus satisfied the content validity.

Method of scoring

The final scale to measure perception of APMFRA comprised of 10 statements, with 5 positive and 5 negative statements covering the dimensions *viz.,* regulation of fishing, registration, licensing, monitoring, conservation and penalties and socio-economic factors. The scoring pattern was on a five-point continuum *viz.,* Strongly Agree (SA), Agree (A), Un decided (UD), Disagree (DA) and

Table 3. Final perception scale: List of items selected with 't' values of more than 1.75

Sl.No.	Items	Actual score	Total score	Relevancy %	Mean Relevance score	t values
1	APMFRA is strong enough to address the challenges faced by the marine fisheries sector of Andhra Pradesh.	99	102	97.06	2.91	2.238
2	APMFRA is not reviewed and updated periodically in response to the emerging issues of marine fisheries sector of Andhra Pradesh.	98	102	96.08	2.88	2.211
3	The scientific advisories from the marine fisheries research institutions are finding place in the APMFRA.	93	102	91.18	2.73	2.103
4	APMFRA fails to protect the needs of fishers, scientific regulation of fishing and maintenance of law and order in the sea.	90	102	88.23	2.65	1.983
5	APMFRA is monitored and implemented strictly by the implementation agency.	89	102	87.25	2.62	1.946
6	The stakeholders' access to the information on marine fisheries regulations and subsequent amendments under APMFRA is very poor.	86	102	84.31	2.53	1.857
7	The mandatory trawl requirements such as Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) are not given adequate emphasis in APMFRA.	81	102	79.41	2.38	1.838
8	The cost structures for registration and licencing of fishing vessels, and the penalty structures for non-compliance under APMFRA are reasonable and justifiable.	78	102	76.47	2.29	1.783
9	Adequate communication mechanisms are in place to create awareness among the stakeholders on the various regulations and amendments under APMFRA.	76	102	74.51	2.23	1.759
10	Adequate conflict resolution mechanism is not in place under APMFRA for enabling better management of conflicts in the marine fisheries sector.	76	102	74.51	2.23	1.834

Strongly Disagree (SDA) with 5, 4, 3, 2 and 1 for positive statements and in reverse for negative statements. The respondent's overall perception score is computed as the sum of scores for all the ten statements.

The perception scale was developed to assess the perceptions of stakeholders towards the effectiveness of Andhra Pradesh Marine Fishing Regulations Act (APMFRA). The method suggested by Likert (1932) in developing summated rating scale was followed for constructing the perception scale. In a study on farmers' perceptions of integrated farming systems in Maharashtra, Argade *et al*. (2015) employed the summated rating method proposed by Likert (1932). Hall (1934) noted that Likert-type scales can yield high reliability coefficients even with a relatively small number of statements. Argade *et al.* (2015) also utilised judges' evaluations to select statements for subsequent item analysis. The reliability and validity assessments of the scale demonstrated its consistency and accuracy in measuring perceptions of the APMFRA among the researchers, extension personnel and fishers in Andhra Pradesh. The administration of the scale among the stakeholders would elicit their perception towards the Act, and the areas to be strengthened for effective fisheries governance such as the regulations which are to be strengthened with the incorporation of scientific advisories, technological measures and conflict resolution mechanisms. This scale can help improve understanding of stakeholder perceptions and contribute to more effective marine fisheries governance in Andhra Pradesh.

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