

## Co-management Feasible in Achieving Fisheries Sustainability? A Case of Oman's Lobster Fishery

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### هل الإدارة التشاركية مجدية لتحقيق استدامة المصايد: دراسة حالة لمصايد الشارخة في سلطنة عمان

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**ABSTRACT.** This study assesses the feasibility of co-management arrangements in managing scalloped spiny lobster (*Panulirus homarus*) fishery in the Sultanate of Oman. The appraisal is conducted using various indicators involving pre-implementation phase and institutional characteristics and substantiated by findings of the review of relevant local and global literature and the results of a structured questionnaire survey conducted during 9-28 June, 2013 with 536 randomly selected fishers from three Governorates namely Al-Sharqiyah South, Al-Wusta, and Dhofar. The former method helps identifying suitable assessment criteria and provides indication of readiness while the later method helps determining primary stakeholders' perceived views on various aspects of regulatory measures and co-management arrangements. While findings related to fishers' commitments, willingness to support government decisions, willingness to participate in co-operative research, and preference for co-operative decision-making are promising, institutional weaknesses identified under the category of 'interactive organization', 'resource ownership and control', 'existence of planned process', and 'diversity' should be of major concerns for policy-makers in moving towards co-management arrangements. Based on the findings some policy implications are also discussed.

**KEYWORDS:** co-management; fisheries sustainability; lobster fishery; Oman.

**المستخلص:** تقم هذه الدراسة جدوى الإدارة التشاركية في إدارة مصايد شارخة الصخور (*Panulirus homarus*) في سلطنة عمان. تم إجراء التقييم باستخدام العديد من المؤشرات شملت مرحلة ما قبل التنفيذ وخصائص المؤسسة مدعومة بمخرجات الدراسات المرجعية المحلية والعالمية ذات الصلة ونتائج استبيان أجري خلال الفترة من 9 إلى 28 يونيو 2013 مع 536 صياداً تم اختيارهم عشوائياً من ثلاث محافظات هي: جنوب الشرقية، والوسطى، وظفار. ساعدت المنهجية الأولى في تحديد معايير التقييم المناسبة كما وفرت مؤشراً على مدى الاستعداد، بينما ساعدت المنهجية اللاحقة في تحديد وجهات نظر أصحاب المصلحة الرئيسيين حول الجوانب المختلفة للتدابير التنظيمية وترتيبات الإدارة التشاركية. وعلى الرغم من أن النتائج المتعلقة بتقيد الصيادين، والرغبة في دعم القرارات الحكومية، والرغبة في المشاركة في البحوث التعاونية، وتفضيل اتخاذ القرارات بصورة تعاونية هي قضايا واعدة، إلا أن الضعف المؤسسي المحدد تحت فئة «المؤسسة المتفاعلة»، و «ملكية الموارد والتحكم بها»، و «وجود خطة للعمليات» و «التنوع» يجب أن تكون أكبر اهتمامات صانعي السياسات في الاتجاه نحو ترتيبات الإدارة التشاركية. في ضوء المخرجات تم أيضاً مناقشة بعض الآثار المترتبة على السياسات.

**الكلمات المفتاحية:** الإدارة التشاركية، استدامة المصايد، مصايد الشارخة، عمان

## Introduction

The 2018 Food and Agriculture Organization of the United Nations (FAO) report on the state of world fisheries and aquaculture highlighted the critical importance of fisheries and aquaculture sector to the global economy and well-being of coastal communities through providing employment, food and nutri-

tional security, and income and livelihoods (FAO, 2018). It is also well-recognized that small-scale fisheries (SSF) that predominate in developing countries constitute a significant part of the global fisheries sector and are critical for socio-economic well-being and food security of the world's most vulnerable communities (Schuhbauer and Sumaila, 2016; Jentoft, 2014; Teh et al. 2011). For instance, Teh & Sumaila (2013) estimated that SSF employ about 22 million fishers (i.e. about 44% of all fishers) engaged in harvesting sector. In a consultative meeting organized by FAO in co-operation with the Ministry of Agriculture and Fisheries (hereafter, MAF) held in Muscat, Oman, March 26-28, 2012, attainment of sustainability in small-scale fisheries in the Near East and North Africa region was highlighted with the purpose of bringing together responsible fisheries and social devel-

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opment (FAO, 2012).

However, SSF in developing countries including the Sultanate of Oman (hereafter, Oman) are usually characterized by the problems of overfishing, overcapacity, non-compliance, weak enforcement, economic inefficiency (Al Siyabi & Bose 2018; FAO 2017; Pomeroy, 2012; Salas et al. 2007). In Oman, the socio-economic significance of the fisheries sector in the country's economic diversification policies and sustainable development drive is well-echoed in the national policy agenda (MNE, 2007a; MNE, 2007b; Bose et al. 2010). For instance, to enhance achievement of economic diversification policy objectives. The fisheries sector has been identified as one of the five promising sectors in the 9th Five-Year Plan (2016-2020) and the sector is expected to achieve an average growth rate of 6.5% (in constant prices) and the share in GDP is expected to rise from 0.5% to 0.6% (SCP, 2016).

Accordingly, considerable efforts have been directed by government agencies in Oman to ensure sustainable utilization of fisheries resources and to maximize socio-economic benefits from the sector (MNE, 2007b). Despite such efforts, some challenges such as overfishing of high value commercial species such as kingfish (Al-Oufi et al. 2004; Al-Balushi et al. 2016) and lobster (Al-Haddabi, 2010), inefficiency in fishing operations (Al-Siyabi and Bose, 2018), weak enforcement and the presence of non-compliance (Al-Subhi et al., 2013; Bose et al., 2017) etc. are still confronting the sector and adversely impacting on the progress towards sustainability in fisheries.

To address these challenges the implementation of co-management approach to effectively manage SSF has been advocated since the late 1980s by the scholars in the field (Jentoft, 1989; Pomeroy, 1995; Sen and Nielsen, 1996; McCay & Jentoft, 1996; Pomeroy & Berkes, 1997; Jentoft, et al. 1998; Jentoft, 2004; Al-Habsi, 2012; Kalikoski & Franz, 2014; to name a few). It is noted that routinely ascribed characteristics such as undemocratic, unfair, and ineffective to the top-down-management approach to fisheries management (i.e. command-and control approach) form the basis for joint action or co-management (Fiorino, 1990; Berkes, 2009).

Co-management has been touted in fisheries management with the expectation to: 1) encourage democratic participation of resource user-groups in regulatory decision-making that helps advancing equity, legitimacy and efficiency (Nielsen et al. 2004; Al-Balushi et al., 2016), 2) improve rule compliance and hence regulatory effectiveness (Pomeroy & Berkes, 1997; Al-Subhi et al. 2013), 3) empower local community (Nielsen et al. 2004) and boost fishers' competence by upgrading their skills through training and through the formation of social capital (for example, fishers' social networks) (Rydin & Pennington, 2000; Schusler, et al. 2003; Nenadovic & Epstein, 2016), 4) foster mutual respect and hence cooperation (Bose & Cress-Morris, 2009), 5) minimize

transaction costs (Abdullah et al. 1998), 6) provide basis for the integration of scientific knowledge with fishers' knowledge and hence improved management (Mackinson, 2001; Bergmann et al. 2004; Hartley & Robertson, 2009), and 7) help broaden decision makers' understanding of user-groups' perceptions and attitudes that improves regulatory effectiveness and the successful implementation of policies (Mackinson, 2001; Jentoft & McCay 1995).

Recognizing these potentials, Al-Oufi (2002), Al-Habsi (2012), Al-Subhi et al. (2013), Al-Balushi et al. (2016) and Bose et al. (2017) advocated the approach to local fisheries management. The encouragement and development of fisheries co-management approach in managing fisheries resources in Oman is also echoed in the development of long-term strategic direction and policy recommendations for the sector by international experts (WB & MAF, 2015). Although, community-based management approach in the form of traditional committee (locally termed as 'Sunat Al-Bahar' Committee) has existed in Oman, the functioning of such committee has diminished over time.(Al-Oufi et al. (2000); Al-Subhi et al.2013). The top-down management approach is more evident in Oman and fishers' participation in decision-making is not well-articulated. While, research on co-management in fisheries was conducted with geographical intent (Al-Oufi, 2002, Al-Habsi, 2012), the feasibility of such management approach has not received adequate attention.

Given this background and considering the strategic importance of the fisheries sector, the main objective of this case study was to assess the feasibility and desirability of co-management approach to the management of the scalloped spiny lobster (*Panulirus homarus*) fishery in Oman. The main reasons for considering lobster fishery are two-fold: first, the fishery has been experiencing a prolonged period of high fishing pressure (Fig. 2). The decline in total landings has caused legitimate concern among policy makers, scientists, and fishers about its possible socio-economic consequences. Second, lobster is one of the high-valued species in Oman and the fishery provides significant employment and income opportunities to the traditional fishing communities.

This research has significance in terms of academic, industry and policy perspectives. While various country-specific studies have been conducted on this approach, however, research on this topic in Oman is scarce, and to this end, this paper not only fills the existing knowledge gap in local research but also complements the existing global literature by adding country-specific case study. The documentation and dissemination of country specific experience have been encouraged by Nielsen et al. (2004) to guide others. Furthermore, by presenting barriers and opportunities for moving towards partnership approach this study contributes to the practical realm as well, as it provides policy makers and fishery managers of local and global

origins with knowledge that has the potential to assist in designing effective strategies.

### Co-management: pros and cons

Co-management was initially considered as a power-sharing arrangement between the management authority and a community of resource users and the concept has been evolved over time with the experience from the field (Sen & Nielsen, 1996; Pomeroy & Berkes, 1997). For instance, Berkes (2009) branded co-management as a process/mechanism of determining power sharing, building institutions, building trust and social capital, solving problems, and as people-centered governance approach.

The emerging interest in the co-management of natural resources has a sound theoretical basis as it has deep roots in public-choice and social-choice theories (Sen, 1995; Ostrom, 1998; Jentoft, et al. 1998). The contrast between these two theoretical postulates is that the former is based on individual rationality where - as '*homo economicus*'—individual behaviour is based on self-interests, while the later promotes an integrated social preference from diverse individual preferences (Sen, 1995). Fisheries managers and policy makers are already aware of the problems caused by biological and economic overfishing, stock depletion, and user-group conflicts associated with open access fisheries (Gordon, 1954; Seabright, 1993). However, with regard to the effective management of common property resources like fisheries (Gordon, 1954) a dichotomy of opinion prevails in the existing literature. One group advocated government ownership or privatization to sustain commons. For instance, to sustain commons Hardin (1968) suggested for some sort of mutually agreed upon coercion involving the government to solve 'the tragedy of commons'. Linked to this proposition, economists argue that adoption of private property rights would results in conservation and economically efficient use of common property resources as the internal benefits and costs accrue to the owner (Schlager & Ostrom, 1992; Ostrom, 2003).

However, opponents (mostly anthropologists and social scientists) argued that this proposition is not cross-culturally valid and have promoted effective local institution by resource users as a way to avoid the 'tragedy' (Acheson, 1989; Ostrom, 1990; Agarwal, 2001). By drawing a distinction between 'common-property' and 'communally owned resources' and citing a number of cases, Acheson (1989) pointed out that communally owned property is not necessarily subject to overexploitation as property owned communally does have an owner after all. Here lies the idea of collective action or co-management as local level management system can co-exist with the centralized institution involving government and avoid 'tragedy' of commons. It is argued that under some circumstances local-level communities can generate institutions and rules to manage their

resources called 'collective' or 'public good' (Ostrom, 1990). Interested readers are referred to Plummer & Fitzgibbon (2004) for further details on a conceptual framework developed through blending theory and practice on co-management.

Despite these potential benefits, some limitations of co-management approach are also documented in the literature. It is argued that no self-interested individuals would join a collective effort when there are incentives generated by externally enforced rules (address free-rider problem) (Ostrom, 2000). Another is the dilemma for legitimacy when representatives have fixed mandates and a system based on personal representation that is, fishers' cooperatives may represent only members' interests (Jentoft, 2000). Next is the accountability and motivation, which are related to human dimension (Grafton, 2007). It is worth mentioning that in reviewing fisheries governance mechanisms involving countries from South East Asia and Southern Africa, Nielsen et al. (2004) provided evidence of mixed results of co-management approach. Similar view of mixed results is also recognized in Cinner et al. (2012).

### Case study background

In Oman, the lobster fishery is located in three Governorates namely Al-Sharqiyah South, Al-Wusta, and Dhofar (see Figure 1). The governorate Dhofar was dominant in terms of landings (67.8%) followed by Al-Wusta (25.8%) and Al-Sharqiyah South (6.4%) (MAF, 2012).

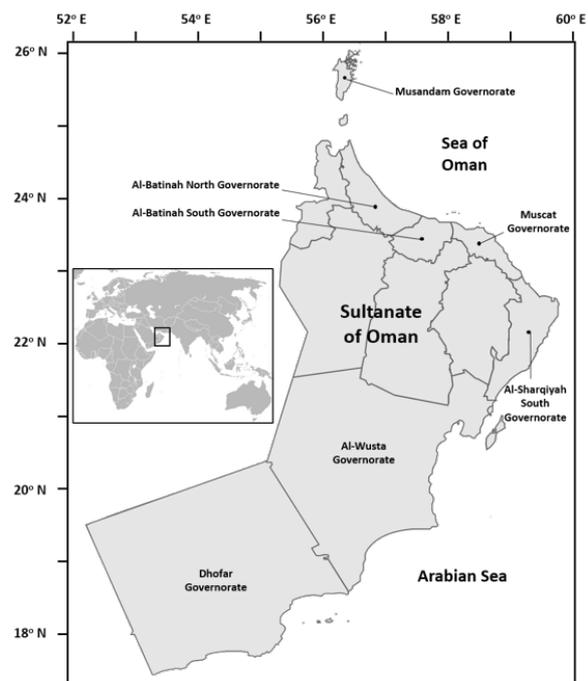
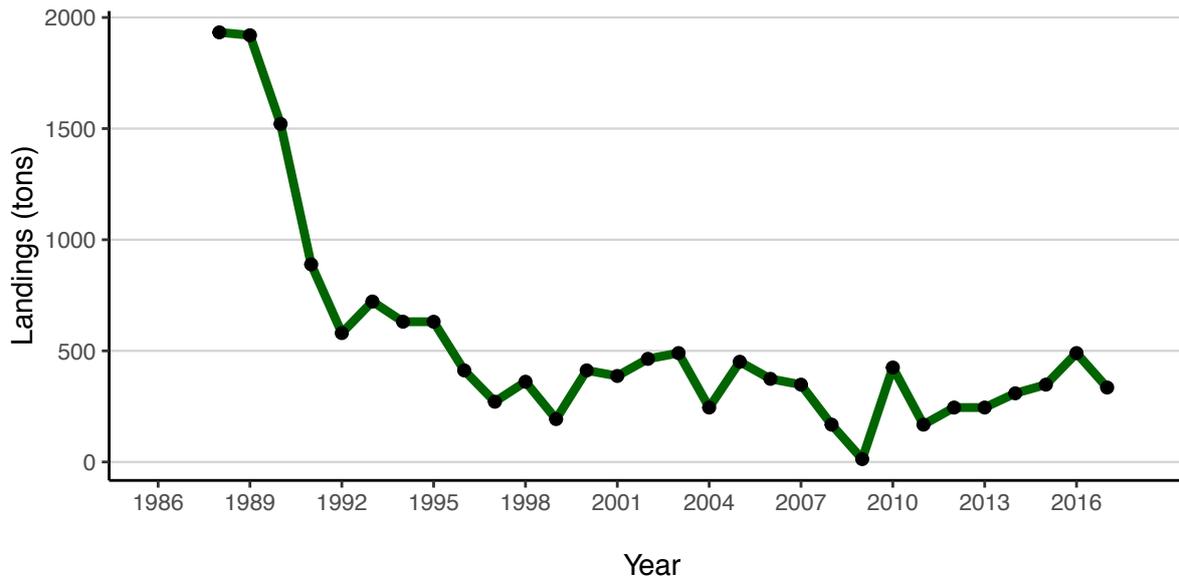
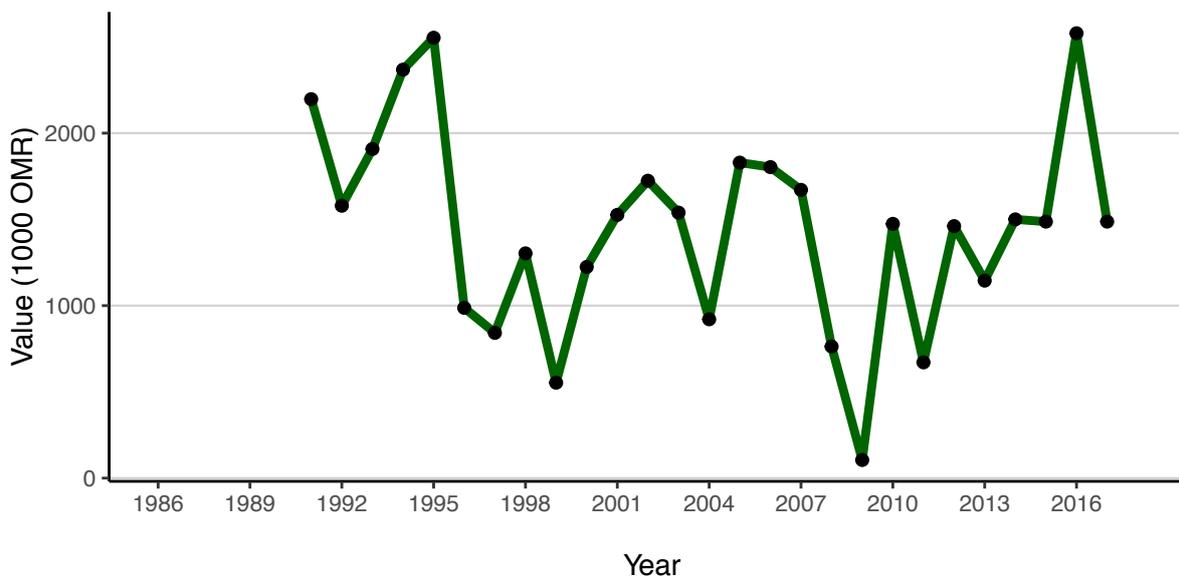


Figure 1. Map of the Sultanate of Oman with study sites



**Figure 2.** Total landings of lobster (mt) from 1988 to 2017.



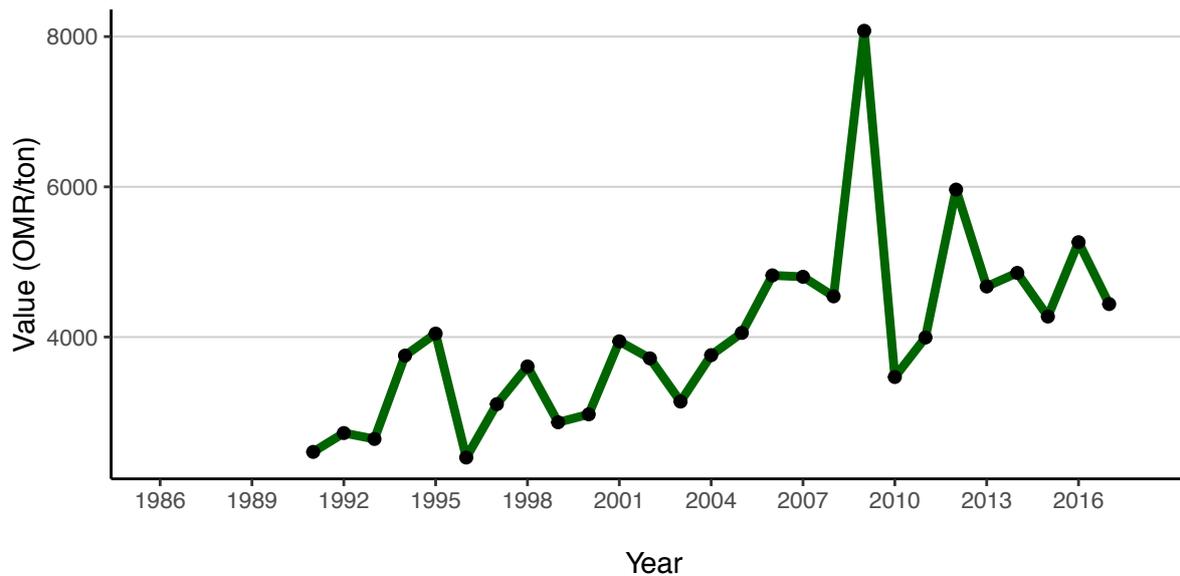
**Figure 3.** Gross value ('000 OMR) of lobster landings during 1991-2017.

The fishery is regulated under the Marine Fishing and Living Aquatic Resources Protection Law and its Executive Regulations. Besides other relevant articles, Article 14 of the Marine Fishing and Living Aquatic Resources Protection Law that is specific to the lobster fishery includes the following elements: 1) prohibition of lobster catching during the breeding and reproduction season, 2) harvesting lobster shall be by lobster traps with specifications determined by the competent authority, 3) prohibition of catching or handling egg bearing lobster, and lobster with carapace length less than 80 mm, 4) prohibition of processing or dealing in lobster during the breeding and reproductive seasons, and 5) amount

of lobsters in possession must be registered at the end of each season with the competent authority.

Since 1986, a number of Ministerial Decisions were issued related to the fishing season in the lobster fishery (Al-Haddabi, 2010). Non-compliance with the regulations includes penalties such as fine (fixed amount and doubled with recurrence of offense), imprisonment, confiscation of catch, gear, boat and license (for a period or permanently) based on court's decisions (Al-Haddabi, 2010).

Artisanal fishers have been using lobster trap, gill-nets and tangle nets to harvest lobster with nets being the dominant fishing gear. This suggests that the regula-



**Figure 4.** Gross value (OMR/mt) of lobster landings during 1991-2017.

tory measure involving fishing gears as stipulated in the *Marine Fishing and Living Aquatic Resources Protection Law* as ‘Harvesting lobster shall be by lobster traps with specifications determined by the competent authority’ has not been enforced. In addition, there is no special license requirement for harvesting lobster. The data from the present study suggests that a considerable number of part-time fishers are involved in the lobster fishery.

According to data on landings collected by the MAF, the lobster landings dropped from 1936 mt in 1988 to 339 mt in 2017, an average growth rate of -5.83% during

the period of 1988-2017 (Fig. 2) with most of the drop during in the first decade. The gross value of lobster catch has shown the similar pattern (but to a lesser extent), an average growth rate of -1.54% during 1991-2017 (Fig. 3). However, it is interesting to note that the unit value of lobster has shown a positive growth (2.12%) during the 1991-2017 (see Figure 4). This indicates an economic potential that can be achieved if the sustainable utilization of the resources was adhered to.

As shown in Figure 2, the fishery has experienced a considerable decline in total landings. During the period

**Table 1.** Assessment criteria with explanatory note for co-management feasibility.

Criteria	Explanatory note
<b>Pre-implementation phase</b>	
Initiator of the idea of co-management	How and by whom the idea of co-management is conceived?
Conditions and driving force	Issues and conditions (i.e. drivers) in fisheries that led to the idea of co-management
Community willingness to support the idea	Extent of fishers willingness to support the idea of co-management
Communicative process comprising participation, preparation, reflection and adaptation	Existence of mechanisms for regular exchange of management information with fishers, fishers’ access and willingness to take part in management meetings, active participation of fishers in the preparation of co-management plan
<b>Institutional characteristics</b>	
Interactive organization	This promotes institutional flexibility not only in terms of space and time but also in terms of process/functions, and structure. It also embraces the presence of advisory organization that represents fishers’ interests. It also points out institutional fitness to accommodate effectively geographically oriented fishing communities.
Resource ownership and control	This includes access and withdrawal rights, collective choice rights (management rights, exclusion rights, enforcement rights, and transfer rights).
Existence of planned process	Existence of the process of preparing co-management plans with clear objectives, and functions and responsibilities of each institutional actor.
Diversity	Comprises equity (i.e. fairness in the representation of the range of interests, and participatory democracy), fisheries contribution to economic development, and fisheries sustainability.

Source: Noble (2000), Chuenpagdee & Jentoft (2007), Cinner et al. (2012).

**Table 2.** Respondent's profile.

Item	Al-Sharqiyah South (N= 68) *		Al-Wusta (N= 106) *		Dhofar (N=362) *	
	No.	%	No.	%	No.	%
<b>Boat Owner</b>	67	98.5	82	96.5	298	83.5
<b>Crew</b>	1	1.5	3	3.5	59	16.5
<i>Participation</i>						
<b>Full-time</b>	63	92.6	25	23.8	225	62.2
<b>Part-time</b>	5	7.4	79	75.2	137	37.8
<i>Experience in fishing</i>						
<b>≤ 10 years</b>	6	8.0	16	15.2	78	21.8
<b>Above 10 years</b>	61	91.0	89	84.7	279	78.2
<i>Educational Status</i>						
<b>≤ Elementary &amp; Preparatory</b>	61	92.4	64	62.7	91	25.4
<b>Above Elementary &amp; Preparatory</b>	5	7.6	38	37.3	267	74.6
<b>Is (was) your father a fisher?</b>	68	100.0	105	100.0	235	65.1
<b>Community dependency on fisheries</b>	68	100.0	67	63.2	295	81.5
<b>Is (was) your father a fisher?</b>	68	100.0	105	100.0	235	65.1
<b>Age of respondent (average years)</b>	44.3		31.2		37.2	
<b>Proportion of annual income from fishing (%)</b>	90		51		46	

\* For each question the percentage figure is calculated based on the total number of responses rather than the overall sample size (N). All figures have been rounded to nearest decimal place.

1988-2017, the fishery experienced changes in management measures related to fishing season including its duration and timing through the issuance of a number of Ministerial Decisions. For instance, a two months period (December-February) fishing season was first introduced in 1992 and subsequently changed to the period October 15-December 15 in 2002. Prior to 1992, fishing season was six months period (October-March). In 2009, the fishery was technically inoperative due to a decision on the shift in fishing season (from 15<sup>th</sup> October -15<sup>th</sup> December to 1<sup>st</sup> March- last day of April). The indicators of severity of exploitation of lobster resources are identified in various studies as follows 1) the catch is dominated disproportionately by younger size group (Mehanna et al. 2012; MAF, 2012; Rogers, 2002), and 2) the dramatic decline in catch over the period (Fig. 2). In addition, a large proportion of egg bearing females in the catch, as pointed out by Mehanna et al. (2012) and Rogers (2002) harms the reproductive potential of the population. There is also a substantial indication of fish-

ers' non-compliance with the regulations specific to the lobster fishery as stated above (Roger 2002, Al-Haddabi, 2010; Mehanna et al. 2012; MAF, 2012) which undermines the effectiveness and legitimacy of regulations.

## Materials and Methods

### Selection of criteria for assessment

Prior to addressing the research objective and to provide specificity to the subject-matter at hand, some relevant criteria were selected from the literature for evaluative purpose. Table 1 presents the selected criteria with brief explanation.

In appraising the pre-implementation stage of co-management, Chuenpagdee & Jentoft (2007) have identified some key criteria that include: i) how and by whom the idea of co-management is conceived, ii) conditions and driving force that led to the idea, iii) community willingness, iv) communicative process, v) participa-

**Table 3.** Crude estimates of average catch, average price, and gross earnings.

Governorates	Average Catch (kg)/ Boat	Average Price (OMR)/ kg	Average Gross Earning (OMR)/ Boat/ Trip	Average Operating Costs (OMR)/ Trip*
Al-Sharqiyah South	7	7.4	51.80	7.00**
Al-Wusta	<b>36.56</b>	5.5	201.08	30.32***
Dhofar	21.03	4.8	100.94	67.60 (for trap)*** 38.15 (for net)***

\* The average operating costs per fishing trip for the fiberglass boats engaged in harvesting kingfish was estimated to be OMR 6.87 (Al-Oufi et al., 2004).

\*\* excluding labor cost.

\*\*\* including labor cost.

tion and preparation, and vi) reflection and adaptation. Similar thematic criteria were also used by Cinner et al. (2012) in analyzing transitions towards co-management involving three African countries. From an institutional perspective, Noble (2000) has added some institutional criteria (along with sub-criteria) that are prerequisites to effective co-management namely: i) the extent of interactiveness in organization, ii) the extent of resource ownership and control by community, iii) level of community support, iv) presence of planned process, and v) diversity. Furthermore, the following important observations are made from a brief review of literature. First, driving forces that led to the introduction of co-management initiatives were not common across countries that provide justification for the case study at hand. For instance, conflicts over fisheries resources that popularized co-management in South East Asia (Nielsen et al. 2004), is relatively uncommon in Oman. Second, while the factors of influence differ in their extent across countries, the overall objective of resource sustainability had been the main attraction to co-management approach. Third, the deliberation of co-management approach helps create a bridge between the two theoretical postulates namely public and social choice theories.

To facilitate the process of assessment, this paper draws evidence from studies on co-management of local and global origins, and elicits fishers' views on various aspects such as, socio-economic, technical, and regulatory aspects of the fishery, awareness of co-management requirements, willingness to participate in management decision-making, monitoring and research, and sharing management responsibilities, etc. A field survey based on face-to-face interviews with a structured question-

naire was conducted during June 9-28, 2013 with randomly selected 536 lobster fishers from three Governorates namely Al-Sharqiyah South, Al-Wusta, and Dhofar. Prior to the design of the questionnaire for the field surveys, a pilot field visit was made to Al-Sharqiyah South (March 17, 2013) and discussions were held with local officials and fishers to gain a clear understanding of the key issues and challenges faced by the fishery. Following the field visit and based on the review of existing literature, a questionnaire was developed. In the absence of any specific register for lobster fishers to draw samples from, the interview was carried out by asking whether the respondent has involvement in lobster fishing. The sampling approach relied on a stratified sampling based on the number of boats involving 11 coastal villages from Al-Sharqiyah South, Al-Wusta, and Dhofar Governorates. The participation in the survey was voluntary and to avoid any inappropriate use of survey information the respondents were kept anonymous according to the code of conduct of the Ministry of Agriculture and Fisheries (MAF). On average it took about 40 minutes to complete the questionnaire in the field. Survey data were processed using Excel and SPSS. A workshop comprising the data collectors was held on June 5, 2013 to reduce potential 'interviewer bias', and to discuss the interview protocol and the structured interview questions. During the workshop data collectors were given opportunity to review the questionnaire and to clarify any question if arises. It can be noted from Table 2-9 that survey questions are both binary and scale-based in nature. The scale-based questions were measured on a five-point scale.

## Results

This section presents respondents' background profile, some economic fundamentals, and the assessment of the feasibility of co-management arrangements in the lobster fishery under the selected criteria presented in Table 1.

### Respondent's profile and some economic fundamentals

Table 2 presents respondent's profile. Majority of the respondents in all study sites were boat owners and had more than 10 years of fishing experience. The number of full-time fishers in Al-Sharqiyah South was comparative higher than that of the other study sites. Overall, a majority of the respondents had low educational attainment with the average age profile ranged from 31.2 years to 44.3 years. It was perceived by the respondents that fisheries are an important part of community livelihoods and the average proportion of fishing income (generated from all fishing activities) out of overall household income ranged from 46% to 90%.

The crude estimates of average catch, average price, average gross earnings, and average operating costs per

**Table 4.** Effect of carbohydrate type and concentration on solanine % (mg.g<sup>-1</sup> DW) in microshoots, callus and cell suspension of in vitro grown *S.nigrum*, in addition to wild (in green house) grown *S. nigrum*.

Item	Fishers Compliance						K-S Test (df =2)
	Al-Sharqiyah South (N=68)***		Al-Wusta (N=106)***		Dhofar (N=362)***		
	No.	%	No.	%	No.	%	
Compliance with fisheries regulations							
≤ 50%	34	50.0	68	64.1	236	65.6	
Greater than 50%	34	50.0	38	35.8	124	34.4	
Violation of lobster fishery rules							
≤ 50%	42	61.8	72	67.9	238	67.0	
Greater than 50%	26	38.2	34	32.1	117	32.9	
Enforcement							
Item (Measuring scale used: 1=Strongly agree and 5=strongly dis- agree)	Al-Sharqiyah South (N=68)		Al-Wusta (N=106)		Dhofar (N=362)		K-S Test (df =2)
	Mean	HFS*	Mean	HFS	Mean	HFS	
Adequacy of enforcement at sea	2.87	4	1.66	2	2.67	2	53.78**
Adequacy of enforcement at landing sites	2.76	4	2.44	2	2.52	2	2.65
Self-enforcement	3.63	5	2.50	2	3.46	5	36.32**

\* HFS represents highest frequency score.

\*\*The Kruskal-Wallis (K-S) test results indicate that the results are significant at the 1% level (Critical value is 9.21).

\*\*\* For each question the percentage figure is calculated based on the total number of responses rather than the overall sample size (N). All figures have been rounded to nearest decimal place.

trip for the boats engaged in lobster fishing are provided in Table 3. The price (OMR/kg) of lobster during the 2013 season ranged from 4.8 OMR in Dhofar to 7.4 OMR (Al-Sharqiyah South). In Al-Sharqiyah South and Al-Wusta, lobster is sold predominantly to retailers and truckers respectively, while retailers, truckers, and companies are engaged in buying lobster in Dhofar Governorate. The average (gross) earning of the respondents from Al-Wusta was about four and two times higher than that of the respondents from Al-Sharqiyah South and Dhofar respectively. During the pilot visit fishers and the local officials reported that lobster catch had always been high during the earlier part of the season and declined gradually towards the end of the season during which fishers divert their fishing efforts to catch other species. In Al-Sharqiyah South and Al-Wusta nets were used for harvesting lobster, however, in Dhofar, both traps and nets were used. On average, the crew members per boat ranged from 2 to 3. The trip duration per day ranged from 5 hours (Dhofar) to 11 hours (Al-Sharqiyah South), and trip numbers ranged from 5 to 6 times per week.

## Criteria-based assessment of co-management feasibility

### Initiators of the idea of co-management

It was evident from a number of local studies that the present-day concept of co-management was embedded in the currently operated Sunat Al-Bahar Committee at coastal *wilayat* level headed by the *Wali* and that includes member from fishing community and the MAF. The 'Sunat Al-Bahar' (meaning the 'code of the sea') historically encompassed rules and person with extensive knowledge. The task of the committee is to study fisheries related decisions of the Ministry, help in solving conflicting issues, and communicate fisheries issues with fishers and the management authority. (Al Oufi et al. 2000; Al-Balushi et al. 2016; Al-Subhi et al. 2013).

However, local studies also pointed out the diminishing role of the traditional committee (Al Oufi et al. 2000, Al-Subhi et al. 2013) and recommended the revitalization of the function of traditional institution to enhance community attitudes to resource use and rule compliance (Al-Balushi et al. 2016; Al-Subhi et al. 2013). Recently, the 2040 strategy developed for the sector by the World Bank (WB) has placed a greater emphasis on

**Table 5.** Views on management regulations.

Item (Measuring scale used: 1=Strongly agree and 5=strongly disagree)	Al-Sharqiyah South (N= 68)		Al-Wusta (N= 106)		Dhofar (N=362)		K-S Test (df =2)
	Mean	HFS	Mean	HFS	Mean	HFS	
<i>Which of the following general tools of fisheries management do you feel are most effective in reducing fishing pressure?</i>							
Size limit	3.13	4	2.26	1	2.84	4	18.92*
Closed season	3.03	4	2.82	1	2.49	1	9.05**
Market control	1.84	2	1.97	1	1.59	1	35.96*
Gear restrictions	2.01	2	2.02	2	1.61	1	41.52*
Closed area	3.07	4	3.36	4	3.15	5	2.08

\*The Kruskal-Wallis (K-S) test results indicate that the results are significant at the 1% level (Critical value is 9.21).

\*\* The Kruskal-Wallis (K-S) test results indicate that the results are significant at the 5% level (Critical value is 5.99).

consultation with stakeholders to improve communication necessary for effective fisheries management (WB & MAF, 2015). Therefore, it appears that local and international experts have been the initiator of the idea of co-management.

### Conditions and driving force

The primary driver of the recent co-management appeal resulted from overfishing of certain high valued species (Al-Balushi et al. 2016), extent of non-compliance (Al-Subhi et al. 2013), weak enforcement (Bose et al. 2017) in general and the catch of undersized lobster in particular (Bose et al. 2017). To address this situation, local researchers recommended the implementation of partnership approach as a tool to revitalize the role of traditional committee, and to enhance awareness, mutual trust and legitimacy (Bose et al. 2017; Al-Subhi et al. 2013).

With regard to the case in hand, inadequacy of enforcement and non-compliance with regulations (Table 4), lack of fair market price, decline in stocks (Table 9), etc. pose threats to both biological and economic viability of the fishery which have been major concerns to both fishers and fishery managers. The decline in lobster stock (Fig. 2), and lack of enforcement and compliance were of common concerns to respondents. A majority of the respondents from Al-Sharqiyah South in particular viewed that fisheries enforcement at sea and at landing sites was inadequate. The extent of compliance with fisheries regulations in general and lobster regulations in particular perceived by respondents is consistent with enforcement inadequacy (see Table 4). It is noted that 'self-enforcement' is not a practical option at the current stage and there was a significant difference in views across the Governorates. Co-operative decision-makings involving fishers and the management authority were preferred by a majority of the respondents across

all Governorates and the non-parametric test results did not show any significant difference in their views (Table 6).

### Community willingness and support

With regard to community willingness and support, the results are positive as respondents acknowledged the resource threats and a relatively high proportion of respondents from Al-Sharqiyah South and Dhofar expressed their high level of commitment to co-management. Furthermore, respondents' were willing to: 1) participate in decision-making, 2) provide fishery-related information, 3) take part in monitoring and enforcement activities, and 4) take part in cooperative research. Respondents were prepared to assist the authority by supporting decisions (Table 7). *When asked if they would like to form a local committee*, a majority of respondents agreed to form a local committee involving relevant stakeholders for effective management of the lobster fishery. It is also noted that a relatively high proportion of respondents from Al-Wusta and Dhofar showed low level of willingness to take full management responsibility (Table 7). This is, perhaps, because they felt they would be unable to manage the fishery on their own and hence co-operative decision-making was preferred by a majority of the respondents across all Governorates as mentioned above. While a generational transfer of fishing profession was observed in case of Al-Sharqiyah South and Al-Wusta Governorates, involvement of new generation fishers (34.9%) was noted in case of Dhofar (Table 2). When asked 'whether they would encourage their next generation to choose fishing as profession' 85% and 43.9% of the respondents from Al-Wusta and Dhofar respectively responded negatively.

### Communicative process

To the best of authors' knowledge no planned process exists at present in connection with the preparation of co-management plan, and therefore, the contemplation of the criteria such as 'participation and preparation' and 'reflection and adaptation' mentioned by Chuenpagdee & Jentoft (2007) was not possible. Furthermore, mechanism for exchange of management information with fishers is unclear and information exchange is irregular in nature.

### Interactive organization

The low level of fishers' participation in traditional institution (i.e. Sunat Al-Bahar committee) undermines its continued existence, operational effectiveness and the advisory role of traditional organization in fisheries management (Table 7). Furthermore, it weakens the representative voice of fishing communities. Responses with regard to the occurrences and level of awareness of consultation meeting, participation in ministry meetings in case of Al-Sharqiyah South and Dhofar, proper acknowledgement of fishers' views raised, extent of fishers' involvement in traditional committee, and level of fishers' representation (particularly in Al-Sharqiyah South), undermine the basic characteristics of interactive organization (Table 7).

The level of awareness of the 'terms and conditions' **Table 6.** Views on management regulations.

of effective co-management that involves, among others, concept clarity, capacities of fishers (i.e. technical expertise, administrative skills, and social cohesion), provision of protection from outsiders, provision of legislative support, credible commitments and accountability from both parties, mutual trust, refraining from opportunistic behaviour etc. (Charles, 2008; Singleton, 2000) was found to be low among respondents across the sampled areas.

### Resource ownership and control

While fishers having valid fishing and boat licenses have the legal right to access the fishery and harvest lobster, they do not possess collective choice rights that include management rights, exclusion rights, enforcement rights, and transfer rights. Furthermore, private property rights for individual fishers or communities in the form of individual quota (i.e. individual/community harvest rights) do not exist in the fishery. There is no clear evidence of power delegation or transfer (i.e. decentralization) of management functions to the traditional community organization to manage and control lobster resources. Furthermore, the scope of delegation and decentralization is diminished by the absence of fishers' technical capacities and lack of awareness about the essentials of co-management approach. The diminishing role of traditional institution within fishing communi-

Questions	Al-Sharqiyah South (N= 68) **		Al-Wusta (N= 106) **		Dhofar (N=362) **		$\chi^2$ test (df=6)
	Yes	%	Yes	%	Yes	%	
Do you agree with having a lobster closed-season?	27	39.7	32	30.2	284	78.5	108.11*
Do you agree with the minimum size restrictions?	52	76.5	44	41.5	306	84.5	88.80*
Do you agree with the restrictions on gear that can be used?	49	72.1	82	77.4	338	93.4	46.05*
Do you agree with the restrictions on taking lobster with eggs?	53	77.9	91	85.8	348	96.1	41.43*
Do you respect lobster closed-season?	67	98.5	92	86.8	342	94.5	11.76
Do you catch lobster during closed season?	3	4.4	16	15.1	13	3.6	53.86*
Do you get lobster as bycatch during closed season?	18	26.5	60	56.6	213	58.8	33.42*
Should the Ministry, the fishermen or both make decisions on managing the lobster fishery?							$\chi^2$ test (df=4)
Ministry	1	1.5	6	5.8	9	2.5	5.48
Fishermen	5	7.4	2	1.9	5	1.4	
Both	62	91.2	95	92.2	348	96.1	

\* The results are significant at the 1% level (Critical values for 6 and 4 dfs at 1% level are 16.81 and 13.28 respectively).

\*\* For each question the percentage figure is calculated based on the total number of responses rather than the overall sample size (N). All figures have been rounded to nearest decimal place.

**Table 7.** Awareness, participation, membership and representation.

Item	Al-Sharqiyah South (N= 68) **		Al-Wusta (N= 106) **		Dhofar (N=362) **	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Awareness of consultation meeting for making regulations	13.2	85.3	34.0	63.2	47.8	51.7
Participation in Ministry meetings (2011-2013)	11.8	88.2	50.9	45.3	37.3	62.7
Recognition of views raised in meetings (if participated)	51.5 (N=47)	17.6	16.0 (N=38)	26.4	19.3 (N=201)	36.2
Membership in Sunat Al-Bahar Committee	7.4	91.2	12.3	84.9	3.9	96.1
Do you feel that Sunat Al-Bahar Committee represents you?	41.2	58.8	81.1	16.0	62.7	36.2

Way of Helping the Authority	Al-Sharqiyah South (N= 68) **		Al-Wusta (N= 106) **		Dhofar (N=362) **		K-S Test (df =2)
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	
Supporting decisions	76.5	17.6	52.8	46.2	94.5	4.1	119.18*
Participating in decision-making	79.4	14.7	72.6	26.4	92.0	4.1	46.02*
Sharing management responsibilities	45.6	48.5	58.5	39.6	71.3	21.3	26.02*
Providing information	61.8	32.4	71.7	26.4	84.5	13.5	19.10*
Monitoring and enforcement	86.8	7.4	58.5	39.6	92.8	5.5	81.93*
Participating in research project	61.8	32.4	30.2	67.0	76.2	15.5	97.14*
Taking full management responsibility	42.6	52.5	21.7	76.4	49.4	39.8	32.64*
Formation of a local stakeholder committee to better manage	67.6	32.4	75.5	22.6	82.0	16.3	9.73*

\* The Kruskal-Wallis (K-S) test results indicate that the results are significant at the 1% level (Critical value is 9.21).

\*\* For each question the percentage figure is calculated based on the total number of responses rather than the overall sample size (N). All figures have been rounded to nearest decimal place.

ties, perhaps, influenced by the ever-changing nature of fisheries issues involving resources and user-group (Nielsen et al. 2004). Across all Governorates, a relatively high proportion of respondents (>50%) raise fisheries issues through the Sunat Al-Bahar Committee (Table 9), however, the traditional committee have no legal rights to impose any regulatory measures.

As discussed earlier the lobster fishery is managed through the implementation of regulatory measures such as closed season, gear restrictions, and size limits, by the management authority. Although the respondents respect the measure of closed season, less than 50% of the respondents from Al-Sharqiyah South and Al-Wusta agreed with the measures. With regard to 'minimum size' a similar pattern was observed in case of Al-Sharqiyah South. A significant difference in the views of the respondents on their agreement with the regulatory measures was observed across the sampled

areas (Table 5). While prohibition of catching egg bearing females, market-based control, and gear restrictions were viewed as effective management measures by a majority of the respondents across the sampling areas, the extent of disagreement reflected through the perceived views on 'closed season' and 'minimum size' indicate the site-specific diversity that require specific attention from the authority (Table 6). Both functional and territorial characteristics should also be taken into consideration to promote equity through participatory democracy.

### Existence of planned process

There is no evidence of common priority-setting efforts with participation from both sides. Lack of efforts in this regard reflects organizational inertia undercutting the progress to improve the situation. Based on the findings it can, perhaps, be suggested that interviewed fishers may not wish to maintain the status quo as the

**Table 8.** Factors of co-management.

Factors	Al-Sharqiyah South (N= 68)		Al-Wusta (N= 106)		Dhofar (N=362)		K-S Test (df =2)
	Mean	HFS <sup>2</sup>	Mean	HFS	Mean	HFS	
Awareness of 'terms & conditions' of Co-management <sup>1</sup>	1.2	1.0	2.1	1	1.9	1	28.33*
Willingness to take responsibility	3.1	5.0	2.6	3	2.1	1	32.95*
Ability to Manage lobster resource	3.2	5.0	2.7	3	2.2	1	29.53*
Level of commitment	4.1	5.0	2.8	3	3.1	5	32.60*

*1*'terms and conditions' of effective co-management involves, among others, concept clarity, capacities of fishers (i.e. technical expertise, administrative skills, and social cohesion), provision of protection from outsiders, provision of legislative support, credible commitments and accountability from both parties, mutual trust, refraining from opportunistic behaviour etc. (Charles, 2001; Singleton, 2000).

*2* HFS denotes 'highest frequency score'.

\* The Kruskal-Wallis (K-S) test results indicate that the results are significant at the 1% level (Critical value is 9.21).

current bio-economic situation (such as stock status, fishing costs, lack of local market outlets, competition etc.) affecting the livelihood of fishers (see Tables 4 and 5). Majority viewed that creating awareness and market opportunity through government initiative would help mitigating such concerns. This signal is conducive to the introduction of partnership arrangements. It is also noted that the existing institutional environments are not unfavorable either as there has been a long tradition of community organization (i.e. Sunat Al-Bahar Committee) and partnership in the sector. However, as noted from the responses (see Table 8), the delegation of responsibilities that suits the capacity of the local committee should be decided upon carefully.

Al-Balushi et al. (2016) argued that the authority could take essential steps to reform the traditional institution by establishing clearly defined roles for and responsibilities of the committee in relation to fisheries management. This action will not only provide an opportunity for the management authority to raise community awareness of fisheries issues, but also help reduce any communication gaps between the authority and the primary stakeholders. It is important to note that such approach focuses on disseminating conservation ethics through awareness programs and helps reduce local opposition to regulations. Of course, the effective solutions to the prevailing issues are likely to emerge over time through a learning process, however, inclusion and transparency in decision-making and, persistent dialogue with community leaders and members could help gain support from the local community.

### Diversity

There is no evidence of the existence of well-articulated process that supports equity in relation to fishers' participation in decision-making. With regard to fisheries contribution to economic development, the existing

conditions identified above will not only weaken the sector's contribution to national food security and community well-being but also fail to ensure access of new generation of fishers to lobster resource. In addition, this study identified some key challenges for the fishery including overfishing, decline in economic returns, market inefficiency, ineffective management measures, lack of enforcement and compliance, amongst others that need to be addressed to protect stock and achieve long-term sustainability.

### Discussion and policy implications

The results associated with boat-ownership, average age profile and the proportion of income from fishing indicate that the livelihoods of those owner operators and younger fishers are linked to the long-term sustainability of the fishery. The results with regard to the dependency on fishing income are consistent with the proportion of part-time fisher in the respective Governorate. The lowest proportion of annual income generated from fishing in case of Dhofar is consistent with Al-Marshudi & Kotagama (2006) who reported that fishers from Dhofar have other jobs along with fishing. The low level of educational attainment particularly in Al-Sharqiyah South and Al-Wusta not only limits fishers' choice of profession as pointed out by Bose et al. (2013), but also fishers' ability to contribute to co-management arrangements. Furthermore, if fishers' unwillingness to encourage their next generation to take fishing as profession is true it may inspire short-term interests of fishers which is not conducive to long term sustainability.

It should be noted that the existing regulatory measure of closed-season was not agreed upon by the majority of the respondents from Al-Wusta and Al-Sharqiyah South. Consequently, the existing management approach will be ineffective and, therefore, will not be able to deliver the desired results. The disagreement

**Table 9.** Raising issues, fishery concerns, and government support.

Item*	Al-Sharqiyah South (N= 68)*		Al-Wusta (N= 106)*		Dhofar (N=362)*	
	No.	(%)	No.	(%)	No.	(%)
Approach to raise fisheries concerns:						
Local Fisheries Office	10	14.7	2	1.9	44	12.2
Sunat Al-Bahar Committee	62	91.2	86	81.1	268	74.0
Wali's Office	4	5.9	48	45.3	142	39.2
Peers	20	29.4	50	47.2	98	27.1
List of major concerns about the lobster fishery:						
Fishing Season	Nil	0.0	Nil	0.0	174	48.1
Decrease in Stock	51	75.0	26	24.5	250	69.1
Non-Compliance	37	54.4	50	47.2	216	59.7
Market Price	39	57.4	11	10.4	1	0.3
Lack of Enforcement	32	47.1	82	77.4	236	65.2
Government Support: (Yes)	67	98.5	65	61.3	341	94.2
Type of support from the Government						
Management	21	30.9	5	4.7	166	45.9
Administration	53	77.9	0	0.0	230	63.5
Training	39	57.4	8	7.5	145	40.1
Research	18	26.5	1	0.9	141	39.0
Creating Market Opportunity	48	70.6	34	32.1	196	54.1
Creating Awareness	58	85.3	4	44.3	229	63.3

\* For each question in the table, the percentage figure was calculated based on the total number of responses rather than the overall sample size (N). All figures have been rounded to nearest decimal place.

with regard to the existing closed-seasons may be influenced by the genetically different stock structures of scalloped spiny lobster (*Panulirus homarus*) as observed by Al-Breiki et al. (2018). Roger (2002) pointed out that if the priority is resource conservation then it is important to determine the reasons behind the non-preference of the existing closed-seasons by initiating a cooperative research. Although a majority of the respondents agree with the gear restrictions, the findings indicate that the use of traps as required by the regulation was not popular among fishers and consequently not followed by the majority of the respondents from Al-Sharqiyah South and Al-Wusta. Presence of significant diversity between Governorates with regard to views and perceptions of fishers should be taken into consideration and evaluated appropriately prior to developing partnership arrangements. The 'one-size-fits-all' approach would not be conducive as the findings indicated significant differences in respondents' preference structures with regard to the extent of participation in co-management.

The driving force behind the move towards co-management for the case in hand was found to be from local scientists and international experts which is in contrast with the findings from Cinner et al. (2012) where move

towards co-management in case of Kenya, Tanzania, and Madagascar was mainly driven by donor ideology and subsequent support. However with regard to conditions that led to the development of co-management idea, the present finding is in line with the case of SSF of Lake Chiuta where circumstances such as environmental degradation and overexploitation of fish stocks led to the government initiated development of co-management in the early 1990s (Donda, 2017). Yang & Pomeroy (2017) mentioned that to prevent the increasing rate of deterioration of SSF resources in the Philippines and due to poor performance of the other management system government actively promoted the development of community-based fisheries management (CBFM). They argued that the CBFM approach improved equity in the fishing community with regard to community participation in fisheries management, control of resource use pattern, the level of bargaining power over decision-making, fair allocation of operational rights and family income.

Respondents' unwillingness to take full management responsibility should not hinder the possibility of co-management approach. Noble (2000) argued that even if fishers are not capable or not willing to take full responsibility of resource management, they can active-

ly participate in planning and decision-making through properly planned co-management arrangements. In addition, Noble (2000) pointed out that a full institutional restructuring is not always necessary to make partnership arrangements possible.

Despite respondents' unwillingness to take full responsibility of resource management (particularly in Dhofar and Al-Wusta) their high level of commitment (Al-Sharqiyah South and Dhofar) and full support for the co-operative approach signify the fact that the approach is demand (fishers)-driven. The management authority should take advantage of this signal and initiate a plan and capacity building efforts through the design of co-operative research projects which may provide opportunities for both parties to collectively arrive at more effective solutions to overfishing and non-compliance problems. Tightly constrained fishery budget make it all the more crucial to reduce management and enforcement costs. Furthermore, the finding with regard to fishers' willingness to take part in cooperative research provides support to design a knowledge-based planning process through the integration of socio-cultural and economic characteristics of local community and ecological knowledge of fishers.

Non-compliance has also been viewed as one of the key factors responsible for overfishing of lobster stock which is in line with the observation by Rogers (2002). The capacity to detect non-compliance is of utmost importance, not only to gain better information for stock assessment purpose but to protect stock and ensure the integrity of management measures and sustainability of lobster resources. As the majority of the respondents are ready and willing to support the authority (see Table 7), local officials and fishers can join together under a partnership arrangement to become stronger and more effective in enforcement monitoring and of rules and regulations. To cite an example, Cinner et al. (2012) pointed out that the enforcement of regulation banning beach seine nets was effective through the establishment of Beach Management Unit (BMU) – a formal organization of fishers and other stakeholders in Kenya. For the present case, the establishment of an integrated compliance program will be critical to the effectiveness of fisheries management. Donda (2017) examined the impacts of co-management arrangements in case of Lake Chiuta, Malawi and observed that such arrangements benefited government in terms of reduced enforcement costs and creating positive image for establishing a sustainable fishery through fostering user participation, and benefited fishers in terms of getting government protection from outsiders, increased income, employment and improved livelihoods. The recent report by the World Bank and MAF mentioned that the commitment to increase stakeholder input and participation in the fisheries sector is an important step toward maximizing voluntary compliance (WB & MAF, 2015).

With regard to respondents' low level of educational

attainment and lack of awareness about the 'terms and conditions' of co-management indicate that intervention to augment fishers' capacity through the development of technical and administrative skills and strengthening traditional institutions through appropriate awareness program may prove beneficial in the long-run and may be the key for resolving local level fisheries issues. In stressing the gender issue in traditional fisheries in Oman and low educational attainment of fisherwomen involved in shellfish fisheries, Bose et al. (2013) also recommended a 'target group'- based approach to skill development programs to equip fisherwomen with generic skills that are easily transferable to other occupations. The 'Fisheries Extension Department' should play a significant role not only in delivering various extension services but also promoting awareness among fishers about their roles and responsibilities in achieving sustainability in the fishery. Fisheries extension program must strive to educate fishers on the association between overfishing and its impact on the resources on which many of the fishers depend for their livelihoods. Capacity building efforts, if they are to be sustained, must include provisions of long-term support from the authority. However, the ultimate success of any co-management initiatives would depend upon their ability to influence fishers' attitudes towards resource sustainability. However, extension officers should receive appropriate training to deliver intended services to fishers effectively. The details of such a partnership arrangement with respect to its type, selection of members, functions, responsibilities etc. need to be worked out.

Considering the fishery situation, an arrangement of participatory management should be considered involving the key stakeholder groups and strived for broad consensus on the management measures to ensure the protection and conservation of the lobster resources. This approach will enhance trust, legitimacy and encourage voluntary compliance and reduce enforcement expenditures. The evolution of co-management institution for Pacific Northwest salmon fisheries as reported by Singleton (2000) illustrates the fact effective partnership approach is possible despite the historical adversarial relations between the state and the American Indian tribes as they were engaged collectively in collecting and analyzing data and implementing other initiatives. In a Canadian case Davis (2008) found that incentive to participate, consensus decision-making and independent facilitation were essential to ensure fairness and effectiveness of the planning process. The process can be developed through the issuance of Ministerial Decision that will not only provide the legal mandate but also help attracting community and industry attention to the fishery. Examples of such decisions can be found in Al-Balushi et al. (2016). The study by Al-Balushi et al. (2016) exemplifies that a co-operative management plan could be developed and differences in interests could be accommodated with impressive rating on the compre-

hensiveness of such plan.

Development practitioners argue that property rights institutions should be designed to be beneficial, flexible, socio-culturally sensitive, politically encouraged, legally and socially recognized, enforceable by a legitimate authority, and conducive to local conditions in order to effectively conserve resources and protect community interests (Acheson, 1989; Seabright, 1993; Agarwal, 1994; Ostrom, 2003).

## Conclusion

This case study focuses on the feasibility of co-management in the lobster fishery of Oman and highlights some strengths and weaknesses related to the feasibility and desirability of such management approach. While findings related to fishers' commitments, willingness to support government decisions, willingness to participate in co-operative research, and preference for co-operative decision-making are promising, institutional weaknesses identified under the category of 'interactive organization', 'resource ownership and control', 'existence of planned process', and 'diversity' should be of major concerns for policy-makers in moving towards co-management arrangements.

Although the results are dependent on the limited indicators used in the feasibility assessment, it is believed that the incorporation of additional indicators in the assessment process would not alter the basic thrusts of the conclusion. If continuity and long-term sustainability of the fishery is a priority, then fishers' commitment in running an economically viable and environmentally sustainable fishing should be secured through a partnership approach. Therefore, without successfully addressing these impediments, any co-management initiatives will not live up to their full potential. The real challenge is to create mechanisms that facilitate coordination between both parties. Genuine attention from the management authority to the subject matter would not only demonstrate the 'sense of moral duty', but would also be in harmony with the national policy direction on the inclusion of key stakeholders in socioeconomic development programs.

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