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Stakeholder influence and relationships inform engagement strategies in marine conservation

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ABSTRACT

Many current marine conservation approaches do not adequately consider the diverse social elements and human aspects necessary to achieve conservation outcomes. The results of conservation research are therefore not always useful for conservation managers to apply in practice. To address this gap, this study combines qualitative methods and quantitative social network analysis to help conservation managers gain in-depth insight into social elements of marine conservation and opportunities that can help achieve conservation outcomes. Specifically, using the North West Shelf Flatback Turtle Conservation Program as a case study, our analysis shows that 1) a stakeholder's position in the turtle conservation network is not the sole or best indicator of their leadership potential to achieve conservation outcomes, 2) peripheral stakeholders are also important for trust, decision-making, and future success, 3) mixed-methods can identify additional opportunities to maintain and further build trust and influence between diverse stakeholders 4) building relationships to support conservation outcomes is accomplished by leveraging stakeholders' roles in the conservation program. By identifying who has influence and who needs to be involved in marine conservation to achieve success, this study demonstrates the value of mixed-methods research approaches. Specifically, our findings show how social network approaches can help conservation managers and stakeholders strategically build communication and engagement strategies that can be used to achieve conservation outcomes.

1. Introduction

Despite substantial growth in marine conservation efforts over the past two decades, biodiversity continues to decline (Díaz et al. 2019; IPBES 2019). This suggests that marine conservation has, in general, not met its aspirational goals. One hypothesis for biodiversity declines is that marine conservation approaches tend to focus on environmental and ecological aims while ignoring social elements and people (Bennett et al. 2017; Bennett 2019). People are a key influence on the success of conservation outcomes. They can cause biodiversity loss, benefit from the resources ecosystems provide, and participate in protecting the environment (Mace 2014). Because of these different relationships with the marine environment, social dynamics and people should be included in conservation approaches to achieve successful outcomes. However, conservation issues are inherently complex, span multiple objectives (social, economic and ecological) across geographical scales are dynamic and affect or involve diverse stakeholders (Giakoumi et al. 2018).

Conservation managers and researchers have the capacity to identify what kind of stakeholders have

potential influence to achieve conservation outcomes (Colvin et al. 2016). However, not all stakeholders have the same level or type of influence; it might be formal, informal, or both (Sandbrook et al. 2013; Mills et al. 2014). Formal and informal influence relationships manifest in different ways to improve decisions and collaborative actions in marine conservation (Quimby and Levine 2018; Cadman et al. 2020). Here, this study explores three aspects of influence: trust, decision-making, and importance for future program success which are linked to improving decisions and stakeholder collaboration in marine conservation literature (Table 1). For example, stakeholders, such as educators and indigenous groups, can have informal influence if they are trusted by other individuals to share and receive information to support conservation outcomes (Crona and Hubacek 2010; Barnes et al. 2017; Escandon-Barbosa et al. 2019; Song et al. 2019). Stakeholders can have formal influence if they have decision-making power to determine or influence the actions and priorities of other stakeholders supporting a conservation program (Weiss et al. 2012; Mbaru and Barnes 2017). Stakeholders can also have both forms of influence if they have the forward-thinking vision to achieve

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Table 1. Formal and informal influence in marine conservation identified from published marine conservation literature on social network analysis and stakeholder engagement.

Characteristics	Type of Influence	Significance of Characteristics for Stakeholders	Empirical Examples
'Trust'	Informal	Stakeholders are trusted to communicate and share information between diverse stakeholders.	(Levin et al. 2006; Fulmer and Gelfand 2012; Kolleck and Bormann 2014; Cvitanovic et al. 2018)
'Decision Making'	Formal	Stakeholders who have influence in decision making can also influence the priorities and actions of other stakeholders supporting conservation outcomes.	(Kellon and Arvai 2011; Pieraccini 2015; Fernandes et al. 2019)
'Importance for Future Program Success'	Formal/Informal	Stakeholders who are important for future success are perceived as critical stakeholders in a conservation program and have the influence and forward-thinking vision to achieve conservation goals.	(Dietz et al. 2004; Bruyere 2015)

conservation outcomes and are perceived as critical to the future success of a conservation program (Dietz et al. 2004; Bruyere 2015).

Conservation often involves a wide range of people with different relationships to the marine environment, which means involving diverse groups of people with different identities, levels of agency, or influence on different parts of the system (Pomeroy and Douvere 2008; Vance-Borland and Holley 2011). Such a complex system might need multiple approaches to develop a richer understanding of the social elements. Mixed-methods research, which combines qualitative and quantitative approaches, is an emerging approach to understand social dynamics in marine conservation (Domínguez and Hollstein 2014; Yousefi Nooraie et al. 2020). Quantitative and qualitative methods inform each other, and consequently, can help researchers gain in-depth insight into social elements of marine conservation and gain a more comprehensive picture of its complexity and the approaches needed to achieve conservation outcomes (Reed et al. 2009; Newton and Elliott 2016; Bennett et al. 2017; Christie et al. 2017).

Quantitative and qualitative approaches can help identify stakeholders, their influence, and their social traits, which can lead to a better understanding of the social elements in marine conservation. Social network analysis is a quantitative approach for mapping who collaborates, and who they can influence, in different conservation objectives Thus, it can inform conservation managers on who may be in the best position to influence planning, decision-making, and activities (Vance-Borland and Holley 2011). This is evident in cases where social networks have identified stakeholders who can coordinate management actions at different scales (Mills et al. 2014; Guerrero et al. 2015), diffuse knowledge across the network (Cvitanovic et al. 2017; Salpeteur et al. 2017), and identify well-connected stakeholders with whom to engage (Bodin and Crona 2009; Ernstson et al. 2010; Henry and Vollan 2014; Bodin 2017). However, qualitative approaches are needed to interpret the social network results by providing a deeper understanding of the social traits (e.g. transparency,

honesty, flexibility) that shape stakeholders' influence and relationships in a network (Rust et al. 2017). Uncovering the qualities of influential individuals in a social network (i.e. whether it is the individual or their role that influences marine conservation) can be important for achieving conservation outcomes (Onwuegbuzie et al. 2009; Adams et al. 2018).

Although social network analysis is increasingly used to inform marine conservation, many studies focus on the theoretical advances of the approach, and the practical application is less explored (but see Prell et al. 2009; Guerrero et al. 2013; Mills et al. 2014,; Adams et al. 2018 as examples of social network analysis in a practical application). Thus, research outputs are not always related to, or translated into, conservation practice (Laurance et al. 2012). This is in part because marine conservation tends to involve long timelines, and thus, the relationships between stakeholders are ever-evolving (Prell et al. 2009). Network analysis can map relationships, but the social network maps only represent a snapshot in time, and so social network analysis alone may not provide a complete picture. How stakeholders and their relationships may evolve in marine conservation can be determined by their underlying social traits in a network (Crona et al. 2011; Barnes et al. 2017).

This study combines quantitative social network analysis and qualitative methods to investigate how stakeholders' influence and relationships inform conservation success. This study uses the North West Shelf Flatback Turtle Conservation Program to identify how stakeholders are connected in a multi-objective, multi-region program to provide insight for conservation managers. The insight is achieved by (a) mapping stakeholder relationships to identify influential individuals using social network analysis (e.g. trusted individuals and central stakeholders (e.g. brokers)) (b) using a qualitative approach to understand the underlying social traits of influential individuals in the social network (e.g. trust, decision-making, and importance for future program success) and (c) using information derived from the above methods to identify the roles or influence that are integral for conservation success, and to improve

future engagement strategies in marine conservation. The methods presented here can help conservation managers and other stakeholders identify who has influence and who needs to be involved in marine conservation to achieve success. This study aims to provide a better understanding of the diverse relationships and social elements in marine conservation, ultimately to increase the likelihood of targeted, and more successful, conservation initiatives.

2. Methods

2.1. Case study

The flatback turtle (*Natator depressus)* is vulnerable to extinction, endemic to Australia (Pendoley et al. 2014; Australia, Co 2017) and has a nesting distribution divided into 7 stocks (Australia, Co 2017, FitzSimmons et al. 2020). This study focuses on the North West Shelf stock with a nesting range between Port Hedland and Exmouth Gulf. The Pilbara region of WA is highly industrialised, leading to issues with shoreline erosions and artificial light, adding to pervasive threats such as climate change and feral animals. (Human and McDonald 2009; C.J. Limpus and Chaloupka 2013) (Figure 1) (Whittock et al. 2014; Kamrowski et al. 2015). To mitigate residual impacts environmental regulators often impose environmental offsets to the conditions of large developments (Hayes & Morrison–Saunders 2007). The creation of offsets attempts to solve the conflicts between conservation programs and industrial development that arise due to trade-offs between economic growth and environmental goals (Delgado-Serrano 2017).

The study region in Pilbara, Western Australia, is the focus of The North West Shelf Flatback Turtle Conservation Program (hereafter the turtle conservation program), which spans the North West Shelf (Figure 1) and is implemented by the Department of Biodiversity, Conservation and Attractions. The turtle conservation program was implemented as an environmental offset to increase the conservation of flatback turtle populations in the Pilbara and has a 60-year, AUD$62.5 million conservation program focused on the protection of flatbacks of the North West Shelf stock (Whiting et al. 2012; Department of Biodiversity, CaA 2017). (https://flatbacks.dbca.wa. gov.au/about) through three key actions:

(1) Surveying, monitoring and research;
(2) Reducing interference to key breeding and feeding locations, and
(3) Establishing effective information and education programs.

The Department of Biodiversity, Conservation and Attractions coordinated the turtle conservation program and ultimately has decision-making power in the program through the Director General but is advised by an Advisory Committee and Expert Panel. The Department of Biodiversity, Conservation and Attractions interacts with and relies on other stakeholders to implement turtle conservation program (e.g. researching critical knowledge gaps, monitoring populations to understand trends, communicating conservation messages, and providing educational material to target audiences). We defined the core groups as the team employed within DBCA to plan and implement the Program. This consisted of
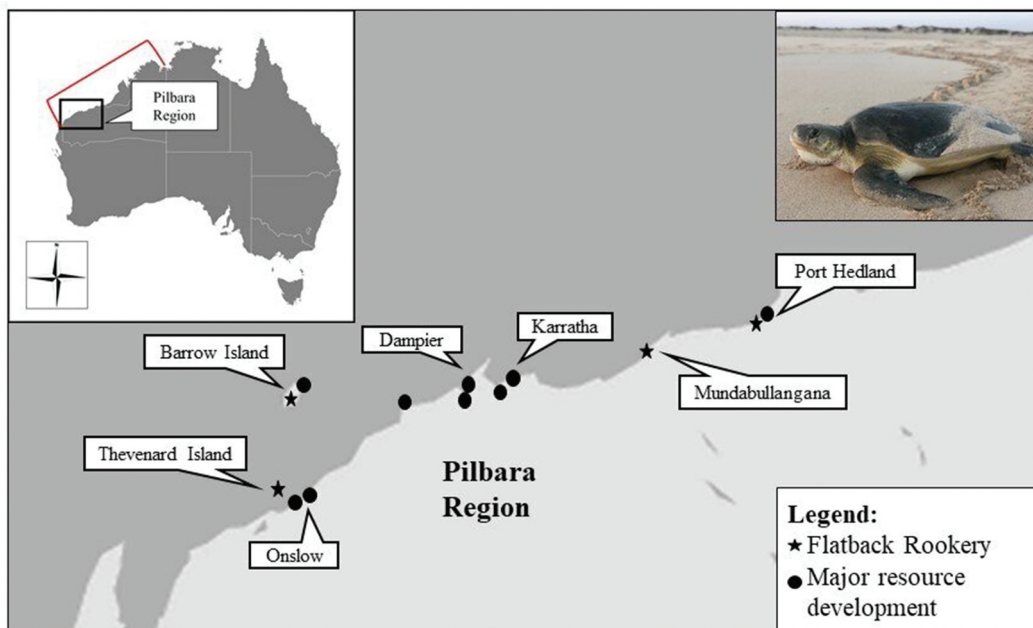

Figure 1. Map of Australia, showing the Pilbara region, which is the focus of North West Shelf Flatback Turtle Conservation Program (red bracket). Flatback rookeries (stars) and major resource developments (dots) in the Pilbara region are shown (adapted from Whittock et al. 2014). This map does not show current stocks of flatback turtles in these regions. (photo credit: lead author (S.I)).

coordinator, scientists, data specialists and communicators. However, other stakeholders are involved in the turtle conservation program to support activities, decisions, and actions. These stakeholders include academic organizations, private consultants, industry-based bodies, government agencies, non-governmental organizations, and community groups. To achieve conservation outcomes, researchers and conservation managers need strategies to identify stakeholder groups in diverse regions and assess their level of influence on the turtle conservation program (Whiting et al. 2012). This case study is an example of a conservation program with many stakeholders and dynamic characteristics. To achieve conservation outcomes, stakeholders and their level of influence need to be identified and incorporated into marine conservation plans and actions.

2.2. Participant identification and recruitment approach

In the turtle conservation program, there are potentially many stakeholders involved including the core group. This study needed to involve the core group because they ultimately make decisions about the turtle conservation program and they rely on their connections with other stakeholders to inform these decisions. Therefore, this study aimed to identify the relevant stakeholders who support actions and decisions in the turtle conservation program.

Stakeholders in the turtle conservation network were identified using a two-step process and then classified based on whether they were directly or indirectly involved in the turtle conservation program; direct involvement involves the core group, and indirect involvement involves the stakeholders supporting conservation outcomes. The initial group of participants, i.e. those directly involved in the program (n = 14) (Step 1, Figure 2) were identified using secondary literature (i.e. relevant websites for the turtle conservation program) and guidance from the program manager. These stakeholders had pre-existing knowledge about the turtle conservation program, pre-existing relationships that supported

objectives or had formal responsibilities including decision-making and prioritizing activities.

In step 2, participants indirectly involved in the turtle conservation program were recruited using snowball sampling to identify stakeholders that otherwise would not have been known in the turtle conservation network and to obtain knowledge about their relationships (Step 2, Figure 1) (Ernoul and Wardell-Johnson 2013; Neal 2015; Berdej and Armitage 2016). Snowball sampling was completed only once to identify indirect stakeholders that support conservation outcomes (i.e. those who could influence decision-making, management actions, or knowledge sharing in the turtle conservation program) (Neal 2015; Berdej and Armitage 2016).

Any individual who was mentioned by two or more participants in Step 1 were invited to take part in Step 2. This approach yielded 16 individuals, three of whom did not respond to interview requests. Thus, a total of 13 participants were interviewed in step 2 and identified 48 new individuals not mentioned by participants in step 1 (Figure 2). These participants were individual stakeholders indirectly involved in the turtle conservation program, including volunteers, research scientists, indigenous representatives, non-governmental organization members, university representatives, industry representatives, and government representatives. Indirect stakeholders researched critical knowledge gaps, monitored populations of flatback turtles to understand trends, mitigating threats, communicated conservation messages, and provided educational material to target-audiences to support the turtle conservation program. The complete stakeholder list included 141 individuals, of which 14 were directly involved, and 127 were indirectly involved in the turtle conservation program.

2.3. Data collection

For this study, qualitative and quantitative data were collected through the same interview guide, but two different techniques were used to interpret and analyse the information. In section 2.3.1 quantitative data were collected and interpreted using social network analysis. In section 2.3.2 qualitative data were
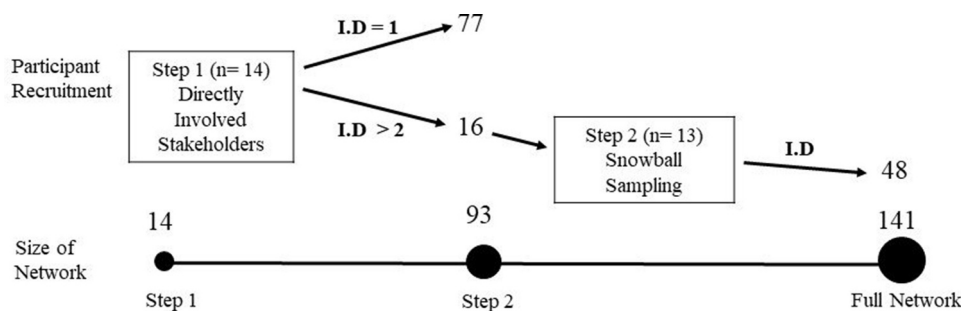

Figure 2. Two-stage participant recruitment process and the development of the turtle conservation network. I.D means identification, and the number of individuals identified in each stage also shown. In Step 1 I.D > 2 is an individual identified two or more times and I.D = 1 is an individual identified only once.

collected and analysed using thematic approaches. The interview guide was developed by drawing on and

adapting existing published social network analysis literature (Barnes et al. 2016; Bodin and Crona 2017; Cvitanovic et al. 2017; Mbaru and Barnes 2017). To ensure the utility of the interview guide, it was first pilot-tested with a co-author (G.P.), refined accordingly, and then tested with the turtle conservation program manager. While in some circumstances, it is not appropriate to test the interview guide on individuals who are part of the core group (Becker et al. 2012), the diversity of stakeholders in this study made it important to ensure that the questions were understandable and applicable to the context (Cvitanovic et al. 2016). Following the piloting process, some questions in the interview guide were revised for clarity (Appendix A).

Prior to commencing interviews, ethics approval was obtained by the Social Science Human Research Ethics Unit of the University of Tasmania (#H0017988). Between March and August 2019, interviews were undertaken face-to-face, via Skype, or by phone. Interviews lasted between 60 to 190 minutes, but most were 60 minutes in duration. All interviews were conducted by the lead author (S.I.) to ensure consistency in the approach. Participants had the opportunity to ask for clarification on any questions they did not understand. The lead author tried to limit response bias during the interviews by keeping personal perspectives on the subject hidden. Each interview was digitally recorded, transcribed, and sent to participants to make changes in their responses if they wanted. Individual names were coded to assure anonymity during the research process.

2.3.1. Quantitative data for social network analysis

The goal of quantitative data collection was to first classify individual stakeholders in the turtle conservation network based on their perceived roles (section 2.3.1.1). To distinguish between perceived and formal roles, stakeholder's formal role was defined as their organizational or institutional affiliation or responsibilities within the organization.

Next, this study identified influential stakeholders based on three formal and informal influence characteristics (section 2.3.2.1).

2.3.1.1. Perceived roles data in the turtle conservation program.
A preliminary list of perceived roles was developed by drawing on existing published reviews of stakeholder typologies and guidelines for engagement in marine conservation and then adapted by participants (Newton and Elliott 2016; Haddaway et al. 2017; Vogler et al. 2017). The responsibility and role an individual stakeholder had in the turtle conservation program may not be the same as their formal role. Therefore, perceived roles were defined as a stakeholders' distinct responsibility, expertise, influence, or knowledge to support the turtle conservation program (Biddle 1986). Participants were first asked to identify up to 10 people who were important to achieve conservation outcomes. Next, participants were asked what perceived role each individual stakeholder had to support the turtle conservation program outcomes.

In some interviews, individual stakeholders were identified with multiple perceived roles. The main perceived role for each individual stakeholder was identified following a four-step process (Figure 3). Online searches were performed to assign roles to the stakeholders who were not interviewed (n = 114). In some instances, the lead-author was unable to determine the individual's formal role from online searches, which were then referred to as an 'unknown role' in Figure 3.

Participants mentioned some perceived roles of individual stakeholders that were not in the preliminary list. As a result, in every interview, the lead author adapted the preliminary list of roles to reflect participants' experiential knowledge of the turtle conservation program. After interviews were completed, 13 perceived roles were identified. The roles were grouped according to a six element framework that the authors have developed, informed by conceptual models and definitions of stakeholders, their roles and actions (Haddaway et al. 2017; Mannetti et al. 2019) (Table 2).

2.3.1.2. Formal and informal influence characteristics.
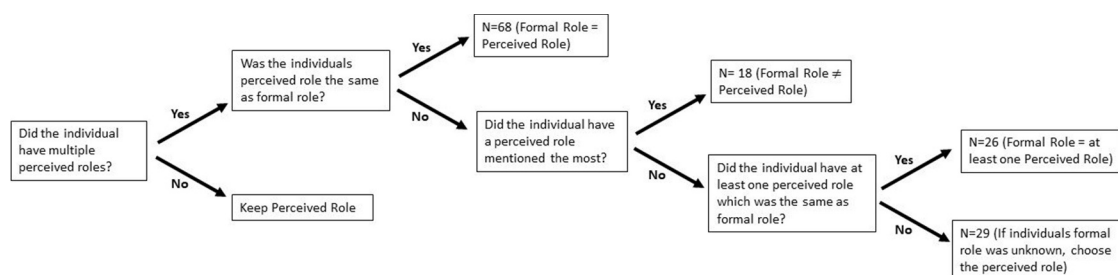To determine the formal and informal influence characteristics applied to the turtle conservation network,

Figure 3. Four-step process to identify one perceived role for each individual in the turtle conservation network based on relationships between stakeholders formal and perceived roles.

Table 2. Perceived roles of stakeholders within the turtle conservation program.

Perceived Roles of Stakeholders in the Turtle Conservation Program	Definition of Perceived Role in the Turtle Conservation Program
Facilitator (facilitator, operational systems, responsible for finances)	Individuals who assist in planning how to achieve program objectives via operational, financial and administrative systems, technical and skill expertise (e.g. monitoring, data collection and training).
Governance (decision making, governance, line-manager)	Individuals with a controlling role for the turtle conservation program decisions and actions including line-managers, decision-makers and leaders.
Knowledge Exchange (research communication, gather information, education)	Individuals who communicate, translate and share different knowledge sources (e.g. scientific research, local ecological knowledge), social and ecological information, educational programs and techniques.
Partnership (build partnership)	Individuals who build collaboration and connections with other stakeholders to add value to the turtle conservation program, increase efficiency and provide support for program activities, objectives and goals.
Public Participation (volunteers)	Individuals from the public who support monitoring work and/or volunteer their time to support program activities.
Research Expertise (experts in technologies, region, research field, researcher, turtle biologist)	An expert holds substantive information on a topic that is not widely known by others (e.g. turtle biology, context on location, specific skill set (e.g. technology).

Table 3. Formal and informal influence characteristics of stakeholders in the turtle conservation program and an explanation of different relationships between stakeholders in the turtle conservation network.

Influence Characteristics	Type of Influence	Question
'Trust'	Informal	Which three people do you trust to receive advice about achieving your goals of the conservation program?
'Decision Making'	Formal	Which three people do you discuss important decision making matters with for the turtle conservation program?
'Importance for Future Program Success'	Formal/Informal	Which three people are most important for the future success of the turtle conservation program?

this study drew on published literature from social network analysis and stakeholder engagement topics (Dietz et al. 2004; Levin et al. 2006; Fernandes et al. 2019) (Table 3). Participants were asked three separate questions about their relationship among important individuals in the turtle conservation program according to three 'influence characteristics'; trust, decision-making, and importance for future program success (Table 3). Each characteristic was visually mapped and represented as a different form of influence to support conservation outcomes. The data were used to visualize relationships between stakeholders and the structure of the turtle conservation network.

2.4. Quantitative data analysis: social network analysis

The turtle conservation network has formal and informal influence relationships between diverse stakeholders.

Network analysis was used to visually map the position of an individual (i.e. core or peripheral node in the turtle conservation network) and interactions between individuals (i.e. number of ties, individuals who act as a connecting force between disconnected individuals) that contribute to optimal conservation outcomes (Bodin et al. 2006; Crona and Bodin 2006; Angst et al. 2018; Said et al. 2019; Karali et al. 2020) (Figure 4). This study used Cytoscape (Institute of Systems Biology (Lopes et al. 2010) to calculate and visually map the turtle conservation network.

An ego-network approach was used for the analyses because the turtle conservation network was based on the connections of direct stakeholders. The turtle conservation network was described by calculating three measures of centrality: 1) centralization, 2) degree centrality, and 3) betweenness centrality that characterizes individuals, subgroups, and the turtle conservation network as a whole (Table 4).
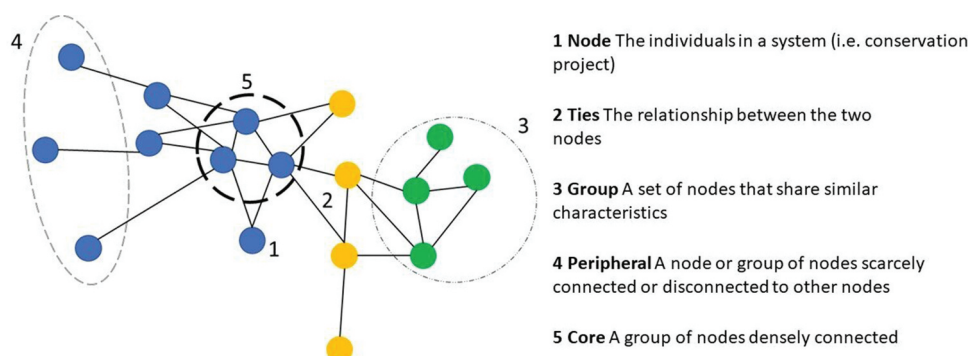

1 **Node** The individuals in a system (i.e. conservation project)

2 **Ties** The relationship between the two nodes

3 **Group** A set of nodes that share similar characteristics

4 **Peripheral** A node or group of nodes scarcely connected or disconnected to other nodes

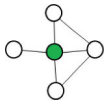5 **Core** A group of nodes densely connected

Figure 4. The basic structural components of a network.

Table 4. Definition of structural measures used in the turtle conservation network analysis and its application (Adapted from (Mbaru and Barnes 2017)).

Measures	Visual Description of Measures	Definition	Empirical Evidence
Degree centrality		Degree is the number of individuals directly connected to one node in a network. In this case, the green node degree centrality = 4.	(Mills et al. 2014; Groce et al. 2019)
Centralization		The extent to which certain individuals are more connected in the network than the others. Of the 21 connections (lines), the green node has 13 connections = 47% of all connections in the network	(Borgatti and Everett 2000; McAllister et al. 2014; Lubell et al. 2017; Gogaladze et al. 2020)
Betweenness centrality		Indentifies individuals that connect separate nodes. The green node is bridging two groups of white nodes and is the shortest path to go through all nodes in the network.	(Guerrero et al. 2013; Bodin et al. 2014; Alexander et al. 2020)

Centralization was used to calculate the extent to which certain individuals are more in a network than other stakeholders (Prell et al. 2008; Sueur et al. 2012; Gogaladze et al. 2020) (Figure 4). A centralized network indicates that certain stakeholders, through their numerous ties, are key figures linking the network together (Crona and Bodin 2006; Prell et al. 2009).

The degree centrality of a node was calculated by the number of individuals directly connected to one node in the turtle conservation network (Table 4). Degree centrality is an indicator of the influence of an individual in a network (Bodin and Crona 2009). Stakeholders with many connections are considered to be hubs and are positioned to exert influence over others in the turtle conservation network.

Finally, the betweenness centrality measures the number of shortest paths that run through an individual to any other individual (Table 4). High betweenness centrality indicates the influence and importance to connect other individuals in the turtle conservation network who were not otherwise connected (Ingold 2011; Angst et al. 2018). In complex stakeholder systems, there can be multiple individuals in a network with high betweenness centrality who can access different knowledge from others in a social network. These individuals can have ties with diverse nodes in the network (i.e. different perceived roles), which help form new ties (Fazey et al. 2013). This is known as heterophily (Yokomatsu and Kotani 2020). Taken together, an analysis of these three measures (Table 4) identified influential individuals in the turtle conservation network.

2.5. Qualitative data about qualities of influential stakeholders

Using the formal and informal influence characteristics identified in section 2.3.1.2, open-ended questions in the interview guide were used to develop an in-depth understanding of individuals in the turtle conservation network (Houghton et al. 2015). Participants were asked to separately explain why individual stakeholders were identified as important for trust, decision-making, and importance for future program success (Table 2). Qualitative approaches provided a holistic understanding of how stakeholders in the turtle conservation network act and helped identify underlying reasons for stakeholders' formal and informal influences. It also allowed generation of a set of social traits to guide conservation approaches seeking to establish and sustain desired relationships in dynamic social networks (Borgatti and Foster 2003).

2.5.1. Qualitative data analysis

Interview transcripts were analysed to identify emergent themes about formal and informal influence in the turtle conservation network and to contextualize the themes in the turtle conservation program. The lead author analysed interview responses on trust, decision-making, and importance for future program success using an inductive thematic approach. An inductive approach was appropriate to analyse the data so that research findings could emerge from the interviews without the restraints imposed by structured methodologies (Hay 2010). A thematic approach refers to the identification and interpretation of themes in qualitative data that are relevant to the research question (LeBlanc 2010).

Using NVivo 12 qualitative data analysis software, we performed a three-step iterative process to identify themes (Bazeley and Jackson 2013). The authors first coded each characteristic decision-making(i.e., trust, decision making, and future success) to identify specific sections in the text that focused on participants' responses to the three influence characteristics (see

Table 5. Number of individuals in each perceived role in the turtle conservation network.

Perceived role	# of individuals for each role
Governance	38
Facilitator	33
Research Expertise	32
Knowledge Exchange	20
Public Participation	12
Partnership	6

Table 3). Next, this study aimed to identify common themes about the qualities of influential stakeholders in the turtle conservation network (i.e. social traits). To identify the qualities of influential individuals, the authors conducted a word frequency analysis to determine which descriptive words were used to identify qualities of influential stakeholders for each characteristic (i.e. code) (e.g., communication, approachable, expertise, etc.). Word frequency was performed based on the re-occurrence of descriptive words in each interview and their connection to three characteristics (i.e. codes).

Following the word frequency analysis, the authors identified similarities between descriptive words found in the interviews to create common themes for each characteristic. This step allowed the authors pay close attention to how the participants framed their responses and how the themes related to different individual's perceived roles. Further, to ensure that emerging themes were valid and relevant, the themes were continually verified against the raw data from which they were derived (Blythe and Cvitanovic 2020). To mitigate individual researcher bias and increase consistency, first, the lead author (S. I.) performed the initial coding of characteristics and word frequency analysis for the interview responses. A co-author (I.vP) checked the coding process and the results to maximize the number of themes identified. Next, the lead author and co-author discussed the similarities and differences between descriptive words for each characteristic and possible ways of interpreting the data. Through this process, the authors identified that there were similar themes that emerged for different characteristics. The lead-author manually went through each interview to con-textualize each theme based on how participants described the qualities of individuals in the transcript. When participants were asked about different characteristics, they expressed similar qualities for individuals, but the way the qualities were framed differed based on the characteristic and individual identified. For example, a quality may have been repeated for different characteristics; however, the individual with that quality or participant who identified the quality differed. The authors then discussed the overlap between themes and decided to keep similar themes across different characteristics.

3. Results

The results of this study are presented in four sections. In section 3.1, the perceived role and location of stakeholders in the turtle conservation network are shown. In section 3.2, social network analysis was used to map the structure of the turtle conservation network and identify influential stakeholders using centrality measures. Social network analysis was also used to determine the ties stakeholders have to other individuals in the turtle conservation network based on their perceived role. In section 3.3, trust, decision-making, and importance for future program success characteristics are mapped on the turtle conservation network to identify important individuals and their relationship to direct stakeholders who manage the turtle conservation program. In section 3.4, themes about the social traits of individuals important for trust, decision-making, and future program success in the turtle conservation network are described.

3.1. Role and location of stakeholders in the turtle conservation network

The turtle conservation network was composed of 141 individuals. Each individual in the turtle conservation network was categorized by one of the six perceived roles to support the turtle conservation program (Table 5). Of the 141 stakeholders, the facilitator role and governance role account for 50% of the individuals in the turtle conservation network, and research experts account for 23% of the individuals.

Of the 141 individuals in the turtle conservation network, 130 are from Western Australia, and 11 individuals are from different parts of Australia or other countries (Figure 5). In Western Australia, 49% of the individuals are in the Pilbara (program site), and 51% are outside the program site. Individuals with different roles in the turtle conservation network are distributed in different locations.

3.2. Social network analysis

3.2.1. Structure of the ego-network in the turtle conservation network

The ego-net structure of the core group of stakeholders who coordinate the turtle conservation program is represented as a series of connections in the turtle conservation network (Figure 6).

In the turtle conservation network, there are 634 ties between 141 stakeholders. The direct stakeholders make up 10% of all stakeholders in the turtle conservation network and have more than 52% (n = 331) of all ties. Of these ties, 72 ties (21%) are to other direct stakeholders. This indicates that 11% of all ties in the turtle conservation network are direct stakeholders' links between one another. The average shortest path
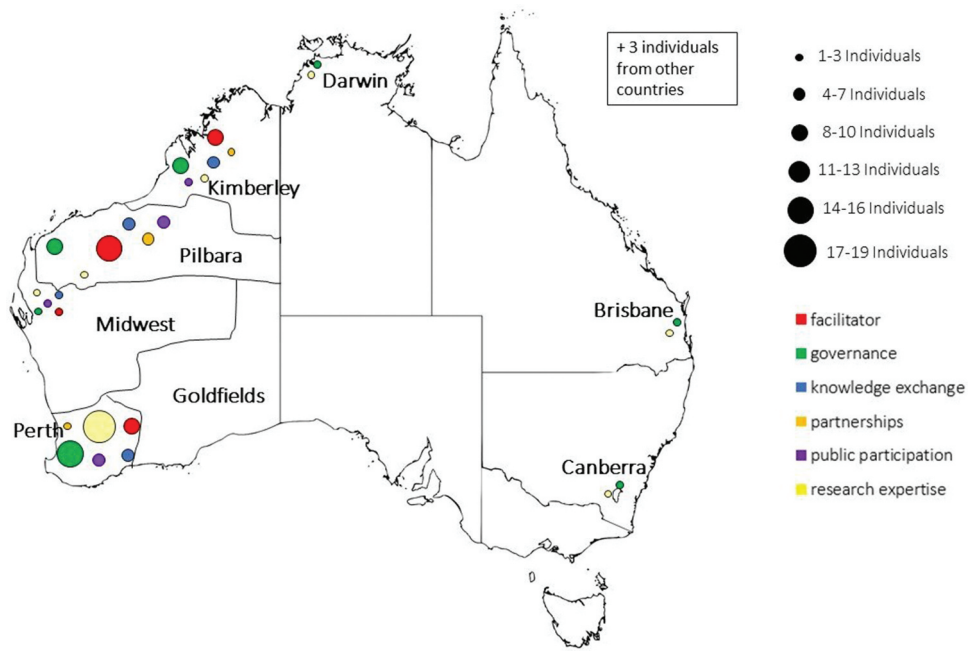
Figure 5. Location of individuals by province in Western Australia, and for several other locations in Australia. The colour shows the role of individuals, and the size of the circle indicates the number of individuals in a role.
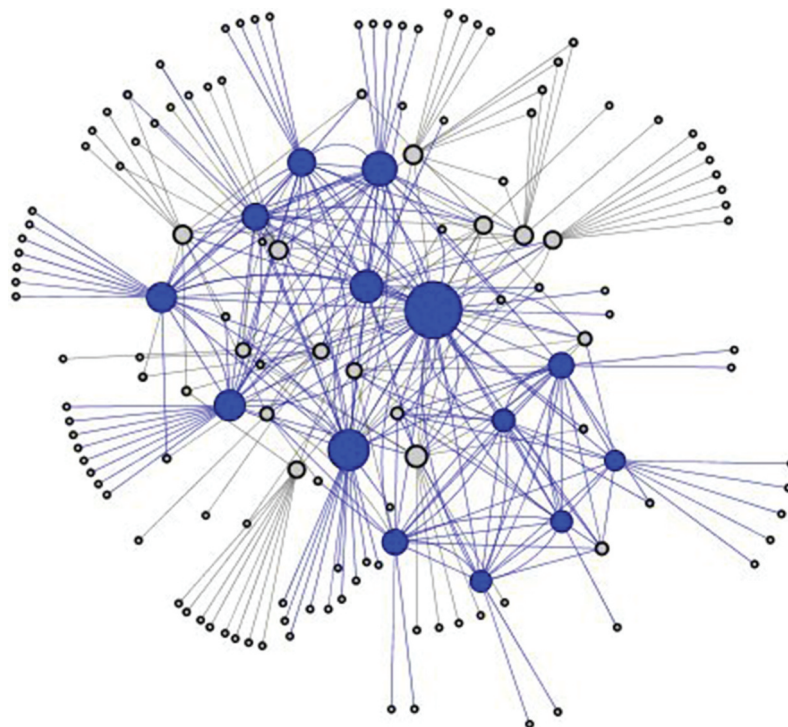

Figure 6. The turtle conservation network. Blue nodes represent a direct stakeholder (n = 14), and the grey nodes represent an indirect stakeholder (n = 127), and node size scaled by degree centrality. Blue lines represent direct stakeholder relationships with other individuals in the turtle conservation network. Grey lines represent indirect stakeholder relationships with other individuals in the turtle conservation network. The size of each node represents the degree centrality of each individual stakeholder.

for a direct stakeholder to connect with other individuals in the turtle conservation network is 2.0.

Of the 141 stakeholders, 21% of the individuals have three or more ties, and 79% have two or less ties to other stakeholders in the turtle conservation network. The turtle conservation network shows a scale-free structure where 20% of people have 80% of the connections. The scale-free structure of the turtle conservation network is
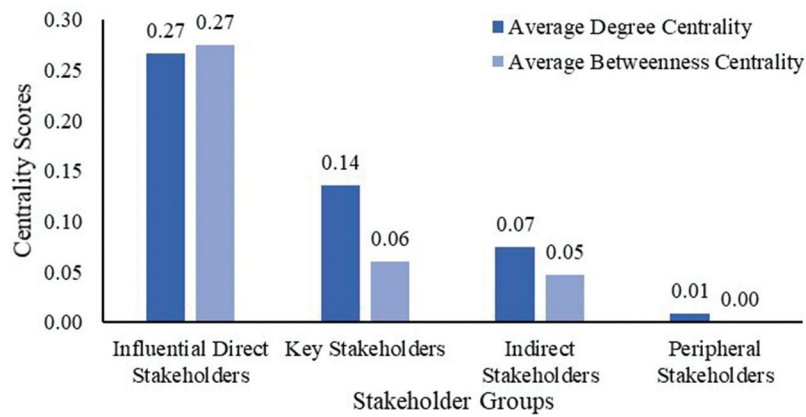
Figure 7. Average degree and betweenness centrality scores for all stakeholders in the turtle conservation network separated into four groups.

the result of using an ego-net approach. In a scale-free network, central individuals are essential for mobilizing a network and bringing other stakeholders together, which reflects the direct stakeholder role (i.e. coordinate and manage turtle conservation program) in the turtle conservation program.

3.2.2. Identifying the most influential stakeholders: betweenness and degree measures

The average betweenness and average degree centrality scores for all stakeholders in the turtle conservation network (Figure 7) were calculated based on the ego-net (Figure 6). To show the distribution of stakeholders influence in the turtle conservation network, stakeholders were divided into four groups based on degree centrality scores. Group 1 are influential direct stakeholders (n = 3), all of whom are direct stakeholders, and all were interviewed (Figure 7). Group 2 are key stakeholders (n = 12), who were all interviewed; however, 11 are direct stakeholders; one is an indirect stakeholder. Group 3 are indirect stakeholders (n = 14), 12 of the 14 individuals

were interviewed. Group 4 are peripheral stakeholders (n = 112); none of whom were interviewed.

Influential direct stakeholders have central roles in the turtle conservation program (Figure 7). Their average betweenness score is at least two times higher than all other stakeholders in the turtle conservation network. Influential direct stakeholders have a structurally favourable position to act as brokers in the turtle conservation network based on their betweenness centrality. However, we expected key stakeholders to have higher central roles in the turtle conservation network because 11 of the 12 key stakeholders ultimately make decisions on conservation actions and put conservation objectives into practice. These results tell us that only three stakeholders, the influential direct stakeholders, are very central in the turtle conservation network.

Peripheral stakeholders had the lowest degree centrality and betweenness score, which is also the result of an ego-net approach because they were not interviewed and their connections in the network were not identified or included. If peripheral stakeholders were interviewed, it is
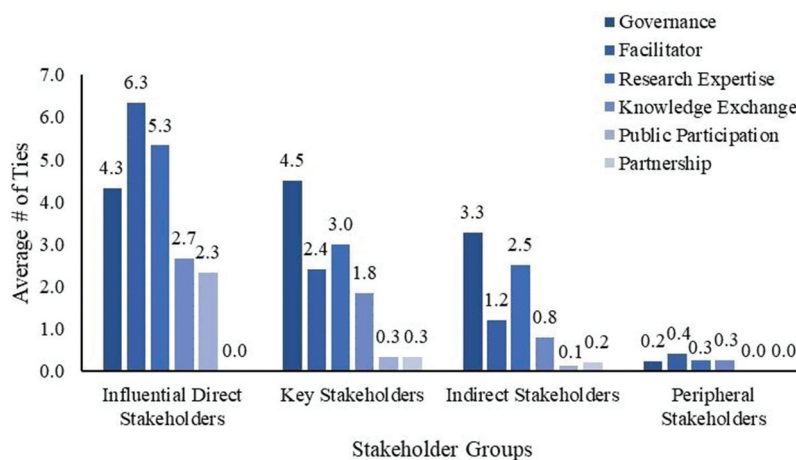

Figure 8. Average number of ties in the turtle conservation network illustrated by perceived roles and separated into four groups.

still unlikely that their position would become more central.

3.2.3. Stakeholders ties in the turtle conservation network

There are 618 ties among the 141 stakeholders in the turtle conservation network. Each stakeholder in the turtle conservation network had an average of four ties. Uncovering stakeholder ties can explain which stakeholders are more likely to influence one another, who may hold similar views, and how information is shared in the turtle conservation network. The ties between all stakeholders in the turtle conservation network (categorized by perceived roles) are shown in Figure 8. All stakeholders in the turtle conservation network were divided into four groups (see section 3.2.2).

Stakeholders in the turtle conservation network have ties with other stakeholders in diverse roles reflecting heterophily (Mbaru and Barnes 2017; De Lange et al. 2019). For example, influential direct stakeholders with high betweenness centrality scores consist of stakeholders in governance, knowledge-exchange, and research expertise roles. They have ties to stakeholders from dissimilar

roles, including public participation and facilitator roles (Figure 8). However, influential direct stakeholders with high centrality scores do not have ties to individuals with partnership roles in the turtle conservation network. Key stakeholders have ties to all roles, including partnership roles, which means they are more heterogeneous in the turtle conservation network.

If all stakeholder groups (Figure 8) reflect the number of individuals for each role in Table 5, this study would have expected the individuals in governance roles to have the highest number of ties, facilitators to have the second-highest, and research expertise to have the third-highest. However, influential direct stakeholders do not have the corresponding number of ties to the number of individuals in each role from Table 5. Influential direct stakeholders have relatively more ties with facilitator roles (those who organize and plan activities to achieve conservation outcomes) than any other role in the turtle conservation network (Figure 8). Key stakeholders have relatively more ties with stakeholders in governance roles (those who make conservation decisions and coordinate actions to achieve conservation outcomes) than any other role in the turtle conservation network, consistent with Table 5.

Figure 9. Stakeholders identified as important for Trust (A), Decision Making (B), and Importance for Future Program Success (C). Node size is scaled by degree centrality.
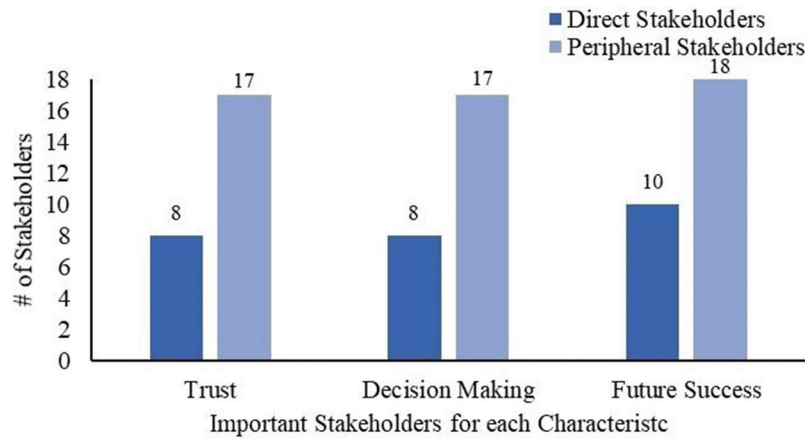
Figure 10. Number of direct stakeholder (i.e ego-net) and peripheral stakeholders identified as important for trust, decision making and importance for future program success in the turtle conservation network.

3.3. Examining the turtle conservation network with trust, decision making, and importance for future program success characteristics

Based on the turtle conservation network (Figure 6), individuals identified as important by participants for trust, decision-making, and importance for future program success were mapped in Figure 9.

By combining qualitative methods and social network analysis, the results show that peripheral stakeholders in the turtle conservation network may still help to achieve conservation outcomes (Figure 9). One-third of the individuals identified as important for the three characteristics are peripheral stakeholders (n = 112) who were not interviewed but can still influence the turtle conservation network. Of these peripheral stakeholders, seven individuals in the trust network (Figure 9A), 10 individuals in the

decision-making network (Figure 9B), and eight individuals in the importance for future program success network (Figure 9C) have no connections to other stakeholders.

Direct stakeholders (i.e. ego-net) and peripheral stakeholders (less than three ties) can be compared for their importance for trust, decision-making, and importance for future program success characteristics in the turtle conservation network (Figure 10). In the turtle conservation network, there were two times more peripheral stakeholders identified as important for all three characteristics than direct stakeholders. However, proportional to the number of direct stakeholders (n = 14), 57% of the individuals were important for trust and decision-making, and 71% of the individuals were important for future program success in the turtle conservation network. Proportional to the number of peripheral stakeholders (n = 112), 15% of

Table 6. Analysis of themes derived from interviews with the turtle conservation program participants. Frequency is the number of times a theme was coded across all interviews.

Characteristics	Theme	Frequency
Trust	Knowledge of flatback turtles and understanding of the turtle conservation program	16
	Communicating and sharing information with stakeholders	13
	Personal relationships with people (e.g. friend, mentor, family member)	10
	Approachable, accountable, and reliable- willing to listen	8
	Honesty, transparency, and directness with stakeholders	8
	Previous experience or involvement in marine conservation programs	6
Decision Making	Leadership role and formal approval in the turtle conservation program	18
	Forthcoming and sharing of information stakeholders need to know or understand for the turtle conservation program	17
	Research expertise for the turtle conservation program and cultural or ecological knowledge	15
	Strategic understanding of the turtle conservation program	11
	Collaborative outlook on decision making in the turtle conservation program	7
Importance for Future Program Success	Knowledge about turtles, informed knowledge about research locations and knowledgeable about the turtle conservation program	52
	Collaborative and inclusive with stakeholders	23
	Helpful facilitating the turtle conservation program or supporting other stakeholders to achieve personal objectives/goals in the turtle conservation program	19
	Directs and leads the turtle conservation program strategically	18
	Experience and understanding of conservation programs globally (i.e. the challenges faced, and how to coordinate diverse stakeholders involved in a conservation program)	17
	Position to facilitate change in stakeholders or turtle conservation program outcomes (diverse management scales- locally or managerial)	16
	Responsible for how finances and resources are distributed in the turtle conservation program	13
	Provides support and guidance to individuals involved in the turtle conservation program and engages in the wider turtle conservation program goals	12
	Has the big-picture vision driving the turtle conservation program	5

the individuals were identified as important for trust and decision-making, and 16% of the individuals were identified as important future program success in the turtle conservation network.

Importance for future program success was the most mentioned characteristic for direct stakeholders. Four of the 14 direct stakeholders were identified as important for all three characteristics. It was expected that all direct stakeholders would have been identified as important for all characteristics. However, our results show that six direct stakeholders were not identified as important for trust or decision-making, and four direct stakeholders were not identified for future program success in the turtle conservation network. By examining the turtle conservation network beyond centrality measures, the results show how peripheral stakeholders can contribute to achieving conservation outcomes.

3.4. Social trait of influential stakeholders in the turtle conservation network

Interview participants were asked why they considered individuals important in terms of trust, decision-making, and importance for future program success to achieve outcomes in the turtle conservation program. Using a thematic analysis approach, 20 themes were identified (Table 6). Each theme illustrated personal or social traits that contribute to an individual's importance for trust, decision-making, and importance for future program success. The number of times each theme was mentioned by participants is shown in Table 6. For example, of the individuals identified as trusted in the turtle conservation network, 16 participants mentioned that knowledge of flatback turtles and understanding of the turtle conservation program was important (Figure 6).

3.4.1. Social traits of trusted stakeholders in the turtle conservation network

Six themes emerged from the interviews about why participants identified trusted individuals in the turtle conservation program (Table 6). Participants noted that trust in an individual varied depending on individual's knowledge of the conservation program, turtle expertise, experience to achieve specific conservation objectives or interpersonal skills. For example, one participant stated,

It's that approachability and they will listen. X is a very similar thing. They might not have the same style of approachability, but if you're honest with them and upfront, they will (Respondent 5, Facilitator).[1]

However, the way participants trusted individuals also depended on the participants' role and responsibilities in the turtle conservation program. Three participants who have managerial positions stated that trust depends on their ability to deliver the ultimate goal of the program through science, education, communication and ongoing action. One participant whose role was to support education and communication actions trusted individuals who have voluntary experience. While an individual in a facilitator role identified trusted individuals based on their experience and expertise in a residential or local setting.

Closely related to this, participants trusted individuals who share similar roles and responsibilities in the turtle conservation program (Table 7). Participants in governance and research expertise roles trusted more individuals who shared their roles than any other roles in the turtle conservation program. Participants in governance roles trusted seven individuals in the same role and two or fewer individuals in another role. While participants in facilitator and knowledge exchange roles trusted more people in governance roles than in the same roles. No participants trusted individuals in partnership roles.

Participants in research expertise, facilitator and knowledge exchange roles also identified trusted individuals based on personal relationships. Trusted individuals based on personal relationships were described as 'being a mentor', 'a good friend', 'family member' or 'known for a long time', while participants in governance roles did not trust anyone based on personal relationships.

3.4.2. Social traits of decision making stakeholders in the turtle conservation network

The importance of decision-making in the turtle conservation network was related to four types of leadership; managerial hierarchy; and expertise, cultural knowledge and leaders at different scales (i.e. district leaders or community leaders). In this study, 28 individuals were identified as important for decision-making. Managerial hierarchy was defined as important for decision-making because of individuals ability to provide formal approval. Of the 18

Table 7. Number of individuals identified as trusted depending on their role. Participants' roles (column) and individuals roles (row).

		Individuals Identified as Trusted (grouped into roles)				
		Governance	Facilitator	Research Expertise	Knowledge Exchange	Public Participation
Participants Grouped into Roles	**Governance**	7	0	2	2	0
	Facilitator	2	4	5	1	1
	Research Expertise	2	0	5	0	0
	Knowledge Exchange	2	1	3	1	2

participants, 22 identified the same individual as important for decision-making. This individual was identified as important because of their ability to sign off before actions are taken.

Individuals important for decision-making were also identified as leaders because of their influence at different scales (e.g. community leader, district leaders). Participants identified important individuals that were located in diverse regions; 10 individuals were located in Pilbara, six individuals were located in the Kimberley, 11 individuals were located in Perth, and one individual was located in Canberra. Participants mentioned that they depended on individual's leadership at different scales to achieve activities and actions in the turtle conservation program. For example, one participant said that an individual in the Kimberley region was important for decision-making because without approval from the community leader,

> 'I could not extend the monitoring of turtles nesting season or change the location if necessary' (Respondent 20, facilitator).

To a lesser extent, individuals who had cultural knowledge were important for decision-making. Participants in knowledge exchange roles and facilitator roles identified three Indigenous representatives as important for decision-making. Participants mentioned that to make decisions for the turtle conservation program 'we' need to engage and support Indigenous groups. For example, one participant stated;

> They have local and cultural knowledge of parks and previous experience of turtle monitoring programs . . . we went to get their advice on cultural matters about how we need to support them being on X country … they have a really good traditional knowledge and knowledge of turtles and how the program runs (Respondent 18, facilitator).

Individuals' expertise was identified as the fourth theme for decision-making. Participants stated that expert advice was required to design future action and progress in the turtle conservation program. Seven of the individuals identified for decision-making had more than ten years of experience working or being involved in turtle conservation. These individuals also had long-term knowledge and experience in marine monitoring and marine conservation, making them important for decision-making.

3.4.3. Social traits of stakeholders important for future program success in the turtle conservation network

Thematic analysis identified nine themes as important for future program success (Table 6). Of these themes, participants differentiated between an individual's managerial influence and personal influence for future program success. Participants identified managerial influence as an individual's ability to distribute finances for the turtle conservation program. Four participants identified important individuals based on their ability to financially support the continuation of the turtle conservation program to continue and provide future outcomes. Three participants identified individuals who could distribute financing to the different organizations that the turtle conservation program relies on to deliver and support conservation outcomes.

Two participants also described managerial influence as individuals in operational roles and their ability to 'get activities done on the ground'. Of the 38 individuals identified as important for future program success, 12 individuals are located in the Pilbara region (location of the turtle conservation program). These individuals were considered the direct link to the conservation program's ability to conduct monitoring programs, research, or activities in different regions. For example, a participant located in Perth acknowledged that in the turtle conservation program, collaboration with individuals in the Kimberley or Pilbara region is critical because of their experience and influence in that region.

Although the managerial influence is important, participants in governance and facilitator roles identified these individuals would not necessarily be the ones who lead or direct that success. These participants identified important individuals based on their personal influence. Participants described personal influence as an individual's 'directness and honesty,' 'relatability,' 'ease to work with', and 'advocacy for change'.

Participants also identified that in a long-term conservation program with such an expansive breadth of research and activities it was important to have people with a big vision. Participants described a major vision as continuously thinking ahead of current activities and making sure all actions lead back to the conservation program goals. They acknowledged that it is easy to lose sight of what the program is trying to achieve and the long-term effects without individuals who have a big vision. Five participants in governance and facilitator roles identified the same individual as having a 'big picture vision' of the turtle conservation program. This individual had the

> Overview and oversight and the direction and how to try and set it up, so it continues for the next 30 or maybe 60 years (Respondent 15, Research Expertise).

Eleven participants mentioned that someone with managerial influence would not necessarily lead or direct the turtle conservation program's success. Instead, what makes people in managerial roles influential for the turtle conservation program's future is their knowledge and experience. For example on participant stated;

> Some of the people I have identified are not replaceable — it is not just their role but their expertise that makes them vital (Respondent 27, Facilitator).

Participants mentioned three different forms of experience and knowledge to describe important individuals for future program success. The three forms of experience and knowledge include: turtle or conservation expertise, turtle conservation program knowledge, and experience interacting with diverse individuals. Turtle expertise was the most mentioned form of experience or knowledge. Individuals with turtle expertise all had between 10 and 40 years' experience working with turtles or conservation.

Individuals ability to interact with diverse groups of people was important for future program success. However, the group of people that individuals interact with differed between participants' responses. One participant in a knowledge exchange role identified important individuals who have experience in public services and bureaucratic knowledge to help the program collaborate with the government in the future. Three participants in governance roles identified one individual who provided a rare point of view for the turtle conservation program because of their exposure and experience working with the industry. Understanding the challenges and restrictions around working with industry made this individual valuable for future program success. Two participants in facilitator roles identified that experience working with Indigenous groups and understanding how to interact with these communities was critical if they were to keep the conservation program going in the long term. These individuals were important because they prioritize building a strong connection between Indigenous people and ensuring that the scientific knowledge is communicated effectively to these groups.

4. Discussion

This study sought to identify patterns in stakeholder connections and influence within a large-scale marine conservation program – the North West Shelf Flatback Turtle Conservation Program. Results suggest that formal and informal influence is distributed across the turtle conservation network and not solely held by stakeholders in central positions. Using mixed-methods, we reveal that when conservation managers seek to achieve various actions and activities in the turtle conservation program it is as important to involve peripheral stakeholders than central stakeholders for trust, decision-making, and importance for future program success. This study also identified additional opportunities to maintain and further build trust, leadership, and brokerage power in the turtle conservation network via the mixed-methods approach. By combining qualitative methods and social network analysis, this study provides a comprehensive picture of social dynamics, and the breadth of stakeholders' influence dispersed across the turtle conservation network. In turn, the mixed-method approach can help conservation managers tailor their communication and engagement strategies to achieve conservation outcomes.

4.1. Key finding: mixed-methods help to identify diverse positions of influence in marine conservation

The turtle conservation program's long-term success may hinge on peripheral stakeholders support and engagement, even though the ego-network shows they have no formal influence. Although peripheral stakeholders have low centrality scores, some of them may be more central than the ego-network approach suggests. Peripheral stakeholders may be perceived as less influential because of their network position, which may lead to exclusion from engagement opportunities in the turtle conservation program (Muñoz-Erickson et al. 2010; Reed et al. 2010; Vance-Borland and Holley 2011). However, using qualitative methods, many peripheral stakeholders were identified as influential for trust, decision-making, or importance for future program success characteristics, indicating informal influence. Therefore, in a complex stakeholder environment, conservation managers should be cognisant of influence beyond the highly central stakeholders (Prell et al. 2009; Crona and Bodin 2010). Inadequate involvement of peripheral stakeholders might limit a conservation manager's ability to leverage knowledge or skills absent from stakeholders in central positions (Ernstson et al. 2008; Bodin and Crona 2009).

4.2. Key finding: mixed-methods identify diverse forms of leadership to support conservation outcomes

In this study, a stakeholder's position in the turtle conservation network is not the sole or best indicator of their leadership potential in the turtle conservation network. Because direct stakeholders are central, they can be effective decision-making leaders when resources need mobilization, and the coordination of joint actions is required (Cinner et al. 2009). However, many marine conservation programs have diverse geographic locations making it difficult for any single group of leaders to achieve long-term conservation planning and complex problem-solving. This is because a single group of stakeholders rarely has the required resources, skills, or knowledge to achieve conservation outcomes (Bodin 2017).

By contrast, some stakeholders with low centrality scores were found, through the thematic analysis, to have leadership roles in decision-making. In the turtle conservation network, leadership roles included community leaders who enable voluntary support and community actions; and individuals with cultural knowledge who have pre-existing conservation practices in diverse settings, as well as local traditions that inform research and conservation activities (Guerrero et al. 2013; Mbaru and Barnes 2017). In complex stakeholder environments, formal leaders are highly

dependent on these diverse leadership roles when trying to achieve conservation outcomes (Cohen et al. 2012). Therefore, to achieve real progress in decision-making, stakeholder coordination and fostering of diverse leadership roles should occur.

4.3. Key finding: mixed-methods identify different forms of trust that can help conservation managers build trust between stakeholders

While in principle trust is positively correlated with centrality (Bodin et al. 2006), in the turtle conservation network, central stakeholders are not always trusted, whil some peripheral stakeholders were. Lack of trust can compromise coordination, knowledge sharing, and collaboration in a network (Song et al. 2019). However, thematic analysis identified that trust in the turtle conservation network had developed from long-term personal relationships, honesty, and transparency with other stakeholders. Honesty and transparency were regarded as a function of sharing information and communication in the turtle conservation network (Kolleck and Bormann 2014). In contrast, personal relationships were dependent on friendships developed over time.

Therefore, building trust in the turtle conservation network takes time and requires harnessing pre-existing personal relationships (Campbell et al. 2016). For central stakeholders to become trustworthy, this study identified that some qualities can be learned, while others are inherent to an individual and their existing relationships. For example, central stakeholders can acquire communication and information sharing through skill-building and learning (Stern and Baird 2015). In contrast, if central stakeholders actively work on personal relationships, they can develop over time, given the 60-year timeline of the turtle conservation program.

4.4. Key finding: mixed-methods inform information sharing and relationship building strategies to achieve conservation outcomes

This study also highlights that mixed-methods can identify brokers' strengths and weaknesses and their relationships in the turtle conservation network. In turn, conservation mangers can understand how specific stakeholders can be engaged in marine conservation to share information, coordinate skills, or generate resources and, hence, contribute to conservation outcomes (Williams and Shepherd 2017). In the turtle conservation network, three direct stakeholders with high betweenness centrality scores were identified as brokers, each with different roles. The mixed-methods approach then revealed whether brokers had relationships with similar stakeholders, whether they were connected to all knowledge and expertise to achieve conservation outcomes, and how to address any gaps in their relationships. In the turtle conservation network, the brokers have relationships

with every role (i.e. research experts, facilitators, public participation, governance, and knowledge exchange roles) except individuals in a partnership role. Thus, brokers in the turtle conservation network are in a good position to access and share diverse skills, expertise, and knowledge used to inform decisions and actions in the turtle conservation program (Bodin and Crona 2009). However, because brokers in this network did not have relationships with stakeholders in partnership roles, these relationships will need to be developed to access the knowledge and skills of individuals whose specific role in the turtle conservation program is to build collaboration.

However, there are other direct stakeholders with less brokerage power who have relationships with stakeholders in partnership roles. Therefore, to avoid knowledge gaps or critical skills, brokers may leverage other direct stakeholder relationships to access the necessary expertise and information to achieve conservation outcomes. This could result in a more robust network with a higher potential for optimal conservation action (Gogaladze et al. 2020).

4.5. Key finding: mixed-methods inform marine conservation engagement strategies

Using a mixed-method approach enables researchers and conservation managers to interpret relationships and influence between diverse stakeholders in a social network. As a result, this study improves our understanding of influence in the turtle conservation network and diversifies the way stakeholders can be engaged to achieve conservation outcomes. For example, a stakeholder may be central due to a high number of social ties; however, centrality does not necessarily mean that the stakeholder is 'highly trusted', or is considered effective in achieving specific conservation outcomes. Mixed-methods can identify stakeholders with influence characteristics who would be neglected in engagement activities if these were based only on network centrality scores (Adams et al. 2018). Mixed-methods may provide a holistic approach to social networks by identifying who holds influential positions and which stakeholders (whether they are identifiable leaders or not) have a prominent role in supporting actions and decisions for conservation outcomes.

In addition to academic interest, using mixed-methods can have substantial implications for conservation managers wanting to establish new collaborative ties between stakeholders in marine conservation. In such cases, it is expected that conservation managers aim to develop ties among a diverse group of stakeholders (Bodin et al. 2017; Schneider and Heinecke 2019) to coordinate actions or share and build knowledge. However, if stakeholders do not have the capacity and capability to act collectively, it is unlikely that engagement strategies informed by social networks will result in the desired increase in collaborative ties (Quimby and

Levine 2018). This is because stakeholders may not have the required level of choice or feel their voice is heard when conservation managers establish new relationships. The results, as presented here, can help conservation managers tailor their communication and engagement strategies. For example, in the turtle conservation network, a precondition to communication and knowledge sharing was having long-term personal relationships with stakeholders. These relationships can then form the basis for stakeholder engagement by fostering collective action and encouraging reflection and adaptation shared with a wider group of stakeholders (Muro and Jeffrey 2008). Conservation managers can cultivate these relationships when implementing actions and building engagement strategies to achieve conservation outcomes.

4.6. The challenges of getting conservation managers to use academic mixed-methods research

Despite our claims for the usefulness of network analysis combined with a qualitative approach, there are some important limitations. Because this research followed the required academic ethics processes, detailed and personalised information about stakeholders could not be shared with conservation managers. The ethics laws developed to protect participants confidentiality prevents disclosure (Ibbett and Brittain 2020). Therefore, conservation managers may be limited in their ability to evaluate and assess social network changes over time. However, if conservation managers were conducting the mixed-methods approach themselves, for example, as part of their regular program activities, they may not have the same confidentiality requirements.

There is a need for a mixed-methods tool that affords conservation managers the capability to understand stakeholder relationships and use this knowledge to inform engagement strategies in marine conservation. However, in this study, the mixed-methods approach was time-intensive and a data-demanding task. A significant limitation to developing a mixed-methods social network analysis tool for conservation managers is the time constraints and resources required to test such a tool (Hauck et al. 2016). Nonetheless, if a mixed-methods tool can be tested in a formative stage and uses iterative approaches, conservation managers can choose a level of investment in social network analysis that supports the development of engagement strategies and hence delivers improved conservation outcomes.

4.7. The need for longitudinal mixed-methods studies in long-term marine conservation programs

While a detailed view was obtained for this turtle conservation network structure and the nature of stakeholder relationships and influence, this study presents a snapshot in time. However, networks (i.e. stakeholders interactions and the roles they have in a network) are dynamic, their composition changes, and the overall context in which they operate also changes. Over the period of time that this research was conducted (2019) to when the paper was written (2020), some direct stakeholders had changed roles, and new experts joined to support new research activities. Given that the 60-year turtle conservation program membership has already evolved in one year, conservation outcomes are likely to continue to evolve, individual stakeholders involved in the turtle conservation program will also need to adapt and change. Therefore, future research might require reassessing the social network structures periodically (i.e. longitudinal mixed-method analysis) to learn about how stakeholder influence develops, changes, and evolves to support conservation outcomes (Cvitanovic et al. 2017). This requires additional time and funding to identify, maintain, or promote desirable relationships among stakeholders, particularly when social network structural changes could inhibit the implementation of conservation actions (Álvarez-Romero et al. 2013). This effort should be considered, as by gaining a greater understanding of influence around diverse stakeholders, their involvement in marine conservation, and different stakeholders perspectives, conservation managers can improve the effectiveness of conservation actions.

5. Broader implications for marine conservation programs

This study can help conservation managers understand and navigate stakeholders' relationships and interests, whom to engage, in what way, and how to build the network or support those involved in a conservation program. However, as detailed in the discussion, greater efforts are needed to build the conservation community's and individual organization's capacity to engage in social network research. This includes prioritizing training in the tools, overcoming identified barriers to do with ethics and methods for social network analysis. However, this, of course, requires time and funding.

This study identified that there are stakeholders, whether peripheral or central, in the turtle conservation network, who have an important role to play for the program's success. These stakeholders, whose roles may range from facilitators to governance and are located across Western Australia. They can help build relationships, provide needed expertise, and support decisions and activities to achieve conservation outcomes. Therefore, efforts should be made to improve diverse stakeholders' functioning. This includes initiating participatory processes to generate or (re)build trust, share information, provide support, and increase collaboration between stakeholders. Further research could address how network structures and forms of influence are most suitable for

different objectives and actions in the conservation program (Barabási 2009, Newman 2003).

This study identified four forms of leadership to support the turtle conservation program (i.e. managerial hierarchy; expertise, cultural knowledge, and leaders at different scales). Our findings support emerging evidence on the importance of multiple sources of leadership in marine conservation programs (e.g. Olsson et al. 2008; Marin et al. 2012). These results provide more precise guidance on which forms of leadership may need to be engaged or may require support to achieve conservation program outcomes. However, to use these results in marine conservation programs, conservation managers need to create strategies that fill necessary capacity gaps by involving diverse leaders to operationalize different decisions, activities, and goals. These strategies, if applied effectively, can create inclusion and local leadership opportunities, technical advisory and skills training, and access to local and non-local expertise and resources.

6. Conclusions

This study used a combination of social network analysis and qualitative interviews to understand stakeholders' decisions within a conservation network and the levels of influence and trust of these stakeholders. The mixed-methods approach showed that the influence of individuals in the network varies based on position and the level of trust vested in them. This research also provides insights into additional opportunities to maintain and further build trust and influence between stakeholders.

More broadly, this study contributes to our understanding of social relations in large-scale marine conservation programs and how to use this knowledge to shape conservation plans and management. Although the results obtained for the turtle conservation network cannot easily be generalized to all conservation programs, insights from this study (e.g. use of mixed-methods) can help improve conservation processes and activities globally.

Note

1. To minimise possibility of identifying individuals, we use 'they' or 'them' instead of 'she/he' or similar to gender neutralized quotes because of the small sample size and the potential of breaching confidentiality.

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Appendix Interview Guide Questions

Throughout the interview, I would like you to answer the questions keeping your personal network (social interactions and personal relationships) in mind rather than your organisation. We want to understand you as an individual's relationship and connections within the wider North West Shelf Flatback Turtle Conservation Program rather than the organisation you work with. If questions are considered specifically for your organisation we will ask directly. We want to understand which interactions are key to make it possible for the program to work, why and how this would happen.

If you have any questions or need clarification throughout the interview, please do not hesitate to ask. Remember if you are not comfortable with any line of questioning please let us know and we will move on.

Context of Participant:
(1) What organisation do you work for?
(2) What is your role within the organisation?
(3) What are your responsibilities within this role?
(4) How long have you been in this role?
(5) How many years have you been involved with marine turtle conservation programs?

(6) Where in Western Australia do you focus your work/programs?

1. List 10 people (in order of importance): To make it possible for you to do your work for the North West Shelf Flatback Turtle Conservation Program, which 10 people you interact with (outside your team) are most important? We want to find out which 10 people you interact with most as part of your work in the turtle program.
(1) What organisation does he/she work for?
(2) What group would you categorize he/she under (e.g. industry, government, academia, indigenous, etc.)?
(3) For you to complete your work in the North West Shelf Flatback Turtle Conservation Program, what links you to this person?
    (1) Funding (has financial commitment to the work you are doing)
    (2) Information (have social and ecological information about turtles)
    (3) Education programs in the North West Shelf Flatback Turtle Conservation Program
    (4) Research
    (5) Partnerships (Add value to program and its efficiency)
    (6) Turtle Biology
    (7) Communication (between governance levels, people)
    (8) Decision-making (help progress action of the program)
    (9) Public Participation (support monitoring work)
    (10) Operational systems (plan and organise work needed to be completed)
    (11) Line-Manager (Who you report to)
    (12) Governance
    (13) Facilitator

2. Questions about the significance of interactions:
(1) Which three people are most important for the future success of this program? (List three) (Is there overlap with your original list?) Are there others not listed here you think are important for the future success? Why are they important?
(2) Which three people with do you discuss important (formal) decision-making matters with for the program? (List three) (is there overlap with your original list) Why do you speak to these three people? (Skills/Capabilities) (role)
(3) Who do you trust to receive advice about achieving your goals of the North West Shelf Flatback Turtle Conservation Program? What is the advice about? (list three)