

Methodology (Extended)

I used a mixed methods single case study approach over multiple visits to the fifteen study communities between September 2019 and March 2020. In total, I spent three months in Palau during this period, based in Ollei village in Ngarchelong State. The research question, “How were the harms and benefits of the sea cucumber trade distributed among fishers in Palau?” was developed after a one-year period of preliminary, unstructured interviews with Palauan fishers, marine scientists, fisheries management professionals, and conservationists from June 2018 to June 2019 based on frequently cited concerns and areas of research interest. Data were collected by me and five Palauan field assistants. Access theory (Ribot and Peluso 2003) was chosen as an analytical frame to identify how individual fishers accessed the benefits of the sea cucumber trade. In the following sections, I justify site selection, provide a brief background on access theory, followed by a detailed description of each data collection method, a summary of how data were analyzed, and a positionality statement.

Site Selection

The fifteen rural villages included in this study represent every village in Ngardmau, Ngarchelong, and Ngchesar states (Image 2). These small communities are all engaged in gleaning sea cucumbers for food security and income, particularly but not exclusively among women. Ngardmau was the most intensive site of harvest for the *bêche-de-mer* trade and is the site known throughout Palau for the quality and abundance of its sea cucumbers. Ngarchelong was intensely engaged in the harvest for the last month of the trade. Ngchesar, which is physically distant from the other states, was largely uninvolved in the trade, providing perspectives from fishers who rely heavily on the resource but who were impacted relatively little by the trade. At the 2015 census, the total population of these three states was 792, including 77 non-Palauan immigrants (Palau Office of Statistics 2015) (more information on population and samples sizes below).

Access Theory

Access theory is a political ecology approach to understanding how individual actors “derive benefits from things” (Ribot & Peluso 2003), with a focus on natural resources as the “things”. Ribot & Peluso placed differential relations among actors and the “things” they want to benefit from at the center of their theory. They were informed by the popular critique that the common property literature is ahistorical and apolitical (Peters 1993; Cleaver 2002; Forsyth & Johnson 2014). “A Theory of Access” took the notion of access as being associated chiefly with enforceable rights and expanded it to encompass a broader range of actors, structures, and social relations, including the illicit (Myers & Hansen 2019). Ribot & Peluso focused on access as an ability, including but not limited to rights. They identified eight structural and relational “access mechanisms” (technology, capital, markets, labor, knowledge, authority, identities, and social relations) in addition to two rights-based mechanisms (legal and illegal access). Survey questions were structured by these mechanisms to understand individual fishers’ ability to derive benefits from the sea cucumber trade. For example, to address the mechanism of ‘technology’, fishers were asked questions including, “Do you own a motorboat?”, “Do you have access to a motorboat?”, “Whose motorboat do you have access to?”, and “Which of the following gears did you use to collect sea cucumbers during this period: mask, snorkel, fins, scuba tank, etc.”.

Data Collection

Survey

To be able to make generalizable and quantifiable conclusions, I used a random sampling approach. I stratified the sample by gender to ensure near-equal representation of women and men. Survey data collection was done by four Palauan field assistants, in Palauan and English depending on the preference of the respondent. Survey respondents were randomly selected by knocking on every other door in each study community on weekends and evenings, when people were most likely to be home and available to respond. In order to capture the greatest possible diversity of respondents, enumerators surveyed as many people within the household as were willing and able. We continued to survey until we reached a sample achieving a 95% confidence interval with a 10% margin of error. In total, we surveyed

100 women and 105 men, including eleven non-Palauan immigrant women and ten non-Palauan immigrant men.

Recognizing that gender and other identities are socially constructed, we asked respondents to self-identify their gender, nationality, marital status, age, level of education, employment status, and whether they held a customary title (a locally relevant measure of power and status). Although we offered multiple gender responses, including ‘transgender’, ‘non-binary’, and ‘other’, 100% of respondents self-identified as ‘woman’ or ‘man’. Thus, results are reported in alignment with these categories. In addition to these identity questions, the survey included questions related to gleaning and local marketing of sea cucumbers, questions related to participation in the 2011 *bêche-de-mer* trade (e.g., “Did you participate?”, “How deep was the water where you were collecting?”, “Which species did you target?”, with at least one question addressing each of the ten access mechanisms identified by access theory), as well as observations of environmental changes. At the end of each survey, we asked respondents whether they would be interested in being contacted for a follow-up interview.

Interviews

To develop a more in-depth understanding of individual experiences and attitudes, I purposively sampled interview participants from the pool of survey respondents, as well as seven Palauan experts on women’s fisheries. Interviews were conducted by me, with the support of a Palauan field assistant and translator. Interviews ranged from ten to ninety minutes and were conducted in English or in Palauan, whichever was preferred by the respondent. Most Palauans today are fluent in English, and some younger Palauans are more comfortable speaking English than Palauan. A limitation of this study is that interviews with non-Palauans were all conducted in English due to a lack of appropriate translators of other languages, so some nuances may have been lost. I selected individuals to interview based on their level of experience gleaning, their participation in the *bêche-de-mer* harvest, their role in management and decision-making (i.e., state rangers and traditional leaders), and their intersecting identities, with the goal of hearing perspectives from people representing a diversity of social positions. In total, I interviewed 26 women and 23 men, including four non-Palauan immigrant women. Interviews were audio recorded and

transcribed in English. In the case of interviews conducted in Palauan, I have not used direct quotes due to the imperfect nature of translations.

Semi-structured interviews focused in greater detail on fishers' access mechanisms to sea cucumbers during the 2011 *bêche-de-mer* harvest, attitudes toward the *bêche-de-mer* trade, and ecological knowledge related to local sea cucumber populations. Though questions related to the precise details of catch amounts and prices were generally avoided due to the eight year gap between the event and this investigation, fishers displayed a remarkable memory for such details, which is possibly due to the unprecedented nature of the *bêche-de-mer* harvest in terms of both volumes collected and prices paid. Such details were thoroughly documented by managers and researchers during and shortly after the trade was closed, which were used to verify information recalled by fishers (Pakoa et al. 2014; Barr et al. 2016). Each interview included an opportunity for the participant to ask questions and provide informed consent, following ethical guidelines and approval from the Stanford University Institutional Review Board.

Data Analysis

Identifying mechanisms of access

To identify key mechanisms of access, I first coded interview data deductively in the Dovetail app (Dovetailapp.com) using the access theory framework. For example, the response, “The men dive and they go fishing, so they know where to collect bakelungal [large-bodied and highly valuable sea cucumbers]; the women don't collect those,” was coded as ‘knowledge’ because it refers to specialized skill-based and ecological knowledge that enabled some fishers to find more valuable species and earn more money. After coding all interviews, ‘technology’, ‘knowledge’, and ‘authority’ arose as the most common and explanatory access mechanisms. I then cross-referenced this finding with survey data, examining how fishers responded to questions on those access mechanisms, for example, whether those who participated in the trade were in fact more likely to be fishing in deeper waters, using free diving gear, and targeting bakelungal compared to “normal” gleaning activities.

Assessing the distribution of benefits and harms

To assess the distribution of benefits and harms, I first coded interview data deductively in the Dovetail app (Dovetailapp.com) using the intersectionality framework. For example, the same response provided above (“The men dive and they go fishing, so they know where to collect bakelungal [large-bodied and highly valuable sea cucumbers]; the women don’t collect those”) was coded as ‘gender’ because it refers to differential access between men and women. After coding all interviews, gender, marital status, and nationality arose as the most explanatory identities.

I then used survey respondents’ self-identified identity markers (e.g., woman, Palauan, 40-45 years old, married, no title, etc.) to assess which actors had the ability to leverage key mechanisms of access during the trade, using Pearson chi-square tests for independence. Significance level was set at $p < .05$. For example, I analyzed whether a statistically significant relationship existed between a woman’s marital status and her access to a motorboat (‘technology’).

Finally, to understand the distribution of harms, I asked survey respondents about changes in local sea cucumber populations since the trade. I also coded interviews for any reference to ‘environmental harm’. This included references to resource degradation, difficulty finding sea cucumbers, and associated challenges obtaining food and income from gleaning.

Positionality Statement

Power gradients between the researcher and “the researched” raise a number of ethical challenges around knowledge generation, ownership, and exploitation, particularly for cross-cultural research and the representation of women (Scheyvens and Leslie 2000). My identities as a white American woman and PhD student shaped how I was perceived by research participants and thus the outcomes of my fieldwork. My extended time in the field and close collaboration with a Palauan NGO, Ebiil Society, on a number of projects related to this research built a degree of familiarity and trust with research participants and ensured that research questions and activities were respectful of local culture and values. I have necessarily interpreted research findings through my own lens.

Survey population and sample characteristics

	Ngardmau	Ngchesar	Ngarchelong	Grand Total
Total Population	185	291	316	792
Total Sample	60	72	73	205
Population of Men	153	257	277	687
Sample of Men	32	34	39	105
Population of Women	87	150	149	386
Sample of Women	28	38	34	100
Population of Palauans	176	271	268	715
Sample of Palauans	59	60	65	184
Population of Non-Palauans	9	20	48	77
Sample of Non-Palauans	1	12	8	21

Summary of statistical results

Result	men	women	p
participation (men & women, normal)	42%	58%	0.0140
participation (men & women, export)	62%	38%	0.0423

boat access (men & women)	81%	69%	0.0438
boat access (non-Palauan men & women)	44%	56%	Small <i>n</i>
Result	married	unmarried	p
boat access (women, marital status)	42%	14%	0.0071
boat access (men, marital status)	44%	27%	0.1632
Result	men	women	
whose boat? (gendered responses)	96%	4%	
gender of state rangers	80%	20%	
Result	Palauan	non-Palauan	
participation in export (Palauan & non)	100%	0%	
boat access (Palauan & non)	66%	45%	

Supplementary Images: fishermen using boats to harvest sea cucumbers in 2011
 (Source of all photos: <https://palau2012.wordpress.com/2011/>)





