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**Programa de Pós-Graduação em Diversidade Biológica e Conservação nos Trópicos**

**MARIANA ANÉLIA COELHO FERREIRA**

# CUSTOS E BENEFÍCIOS DE ÁREAS PROTEGIDAS: compreendendo as percepções dos usuários para uma gestão territorial mais equilibrada

**MACEIÓ - ALAGOAS**

**Fevereiro/2025**

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**Dissertação apresentada ao Programa de Pós-Graduação em Diversidade Biológica e Conservação nos Trópicos, Instituto de Ciências Biológicas e da Saúde. Universidade Federal de Alagoas, como requisito para obtenção do título de Mestre em CIÊNCIAS BIOLÓGICAS, área de concentração em Conservação da Biodiversidade Tropical.**

**Orientador(a): Prof. Dr. Rafael Ricardo Vasconcelos da Silva**
**Co-orientador: Prof. Dr. Guilherme Ramos Demétrio Ferreira**

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Mariana Anélia Coelho Ferreira

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Dr. (ª) – Rafael Ricardo Vasconcelos da Silva/UFAL - Orientador

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Dr.(ª) – Alexandre Schiavetti

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## RESUMO

A conservação ambiental é essencial para o desenvolvimento sustentável, pois contribui para a mitigação das mudanças climáticas, a manutenção da biodiversidade e o bem-estar humano. As Áreas Protegidas (APs) de uso sustentável desempenham um papel fundamental nesse contexto, equilibrando a proteção dos ecossistemas com as demandas socioeconômicas. No entanto, sua eficácia depende de uma governança participativa, capaz de reconhecer os impactos desiguais das políticas de conservação sobre diferentes atores sociais. Assim, este estudo investiga como fatores socioeconômicos e experiências de uso influenciam as percepções sobre diferentes dimensões de custos e benefícios (econômicos; socioculturais; ecológicos; territoriais) da Área de Proteção Ambiental Costa dos Corais (APACC), a maior Área Marinha Protegida do Brasil. Para isso, foram realizadas 300 entrevistas com quatro grupos de usuários da APACC, sendo estes: i) moradores locais não pescadores; ii) pescadores artesanais; iii) comerciantes e empresários do setor turístico; iv) turistas e visitantes. As coletas ocorreram em três regiões da APACC, sendo estas a Região Sul (Paripueira), Rota Ecológica (São Miguel dos Milagres e Porto de Pedras), e Polo Turístico (Japaratinga e Maragogi), com 100 entrevistas por região. Para analisar as influências das variáveis socioeconômicas e de experiência de uso sobre a percepção de custos e benefícios, foram utilizados Modelos Mistos de Ligação Cumulativa (CLMM), ajustando modelos separados para custos e benefícios. Os resultados indicaram que pescadores artesanais e indivíduos com renda familiar abaixo de um salário mínimo perceberam mais custos associados à APACC. Por outro lado, turistas e visitantes, assim como indivíduos sem educação formal, demonstraram maior percepção dos benefícios. Em relação às dimensões, os benefícios ecológicos e socioculturais foram amplamente reconhecidos, enquanto os custos territoriais se destacaram, sobretudo entre pescadores artesanais, empresários e comerciantes do turismo e moradores locais não pescadores. Os resultados sugerem que atividades econômicas ligadas ao turismo e à pesca artesanal devem ser priorizadas na gestão da APACC, sem negligenciar desigualdades na percepção dos custos. Além disso, é essencial que futuras pesquisas e políticas de conservação proponham meios de reduzir os custos e ampliar os benefícios, especialmente para comunidades tradicionais vulneráveis, fortalecendo a inclusão e equidade social.



**Palavras-chave:** Percepção ambiental. Custo-benefício. Área Marinha Protegida.

## ABSTRACT

Environmental conservation is essential for sustainable development, as it contributes to climate change mitigation, biodiversity maintenance, and human well-being. Protected Areas (PAs) for sustainable use play a fundamental role in this context, balancing ecosystem protection with socioeconomic demands. However, their effectiveness depends on participatory governance, capable of recognizing the unequal impacts of conservation policies on different social actors. Thus, this study investigates how socioeconomic factors and user experiences influence perceptions about different dimensions of costs and benefits (economic; sociocultural; ecological; territorial) of the Costs dos Corais Environmental Protection Area (APACC), the largest Marine Protected Area in Brazil. For this, 300 interviews were conducted with four groups of APACC users: i) nom-fishing local dweller; ii) artisanal fisher; iii) tourism entrepreneurs and traders; iv) tourists and visitors. The data collection took place in three regions of APACC: South Region (Paripueira); Ecological Route (São Miguel dos Milagres e Porto de Pedras); and Tourism Pole (Japaratinga e Maragogi), with 100 interviews per region. To analyze the influences of socioeconomic variables and user experience on the perception of costs and benefits, Cumulative Linkage Mixed Models (CLMM were used, adjusting separate models for costs and benefits. The results indicated that artisanal fishers and individuals with a family income below one minimum wage perceived higher costs associated with APACC. On the other hand, tourists and visitors, as well as individuals without formal education, demonstrated a greater perception of benefits. Regarding the dimensions, the ecological and sociocultural benefits were widely recognized, while the territorial costs stood out, especially among artisanal fishers and non-fishing local dweller. The results suggest that economic activities linked to tourism and artisanal fishing should be prioritized in the management of APACC, without neglecting inequalities in the perception of costs. Furthermore, it is essential that future research and conservation policies propose ways to reduce costs and increase benefits, especially for vulnerable traditional communities, strengthening inclusion and socio equity.



**Key-word:** Environmental perception. Cost-benefit. Marine Protected Area.

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# 1. APRESENTAÇÃO

A conservação ambiental vai muito além da proteção da natureza e de seus atributos bióticos e abióticos. As medidas de conservação também são essenciais para o desenvolvimento sustentável e para a garantia da qualidade de vida e o bem-estar humano (KUHLMAN & FARRINGTON, 2010; DA SILVA et al., 2017; CARVALHO, 2023). Aparentemente, a sensibilização sobre a responsabilidade ambiental e sua importância para o desenvolvimento sustentável tem crescido ao longo do tempo. Dessa forma, as Áreas Protegidas (APs), a depender do modelo de conservação, são ferramentas de proteção ambiental que podem atuar em prol do desenvolvimento sustentável e dos valores culturais associados ao meio ambiente (WELLS & MCSHANE, 2004; WYMAN et al., 2011; OPRŠAL et al., 2018; BHAMMAR et al., 2021; GATISO et al., 2022; THAPA & DIEDRICH, 2023).

Além disso, quando bem geridas e com gestão participativa, as APs podem gerar benefícios socioambientais, uma vez que, estas são espaços onde podem ocorrer interações sociais, geração de renda, educação e sensibilização ambiental, desde de que essas ações estejam alinhadas à proteção ambiental (BRASIL, 2000; WEST et al., 2006; GAMARRA et al., 2019; MASUD et al., 2022; MESTANZA-RAMÓN et al., 2023). As experiências pessoais e coletivas em ambientes naturais destinados à proteção ambiental podem reforçar o sentimento de conexão com o meio ambiente e a intenção em protegê-lo, não apenas por seu valor intrínseco, mas também pelo valor instrumental, ou seja, os benefícios que a natureza provê para os seres humanos (BALLANTYNE et al., 2011; HAUSMANN et al., 2016; WEILER et al., 2018; LIOBIKIENĖ & POŠKUS, 2019; ZHANG et al., 2020).

No entanto, para que as APs sejam bem sucedidas, diversos fatores devem ser levados em consideração, como o planejamento, governança e gestão participativa (WELLS & MCSHANE, 2004; WOODHOUSE et al., 2018; DE OLIVEIRA JÚNIOR et al., 2021). Também é importante que haja o reconhecimento de que a conservação ambiental e o desenvolvimento socioeconômico não são exclusivos, mas sim objetivos que podem estar alinhados beneficiando um ao outro (OLDEKOP et al., 2016). Além disso, é necessário contar com recursos financeiros e funcionários para que ocorra uma administração espacial eficiente (CALDECOTT & JEPSON, 2014; JEPSON et al., 2017). Ao promover a proteção da biodiversidade, dos ecossistemas e seus serviços ambientais e sociais, ou seja, os benefícios que as pessoas capturam dos ambientes naturais (FU et al., 2012), as APs quando geridas através do modelo de uso sustentável, podem estimular o desenvolvimento econômico local através de

atividades econômicas que geram empregos e renda para as comunidades locais, como o turismo, a pesca artesanal e a agricultura (WYMAN et al., 2011; BHAMMAR et al., 2021; THAPA et al., 2022; GAMARRA et al., 2023).

Mas embora as APs gerem diversos benefícios ambientais e sociais, quando negligenciadas ou geridas apenas pela perspectiva ambiental sem a inclusão das pessoas como parte atuante na natureza, estas podem gerar custos que excedem os benefícios (WYMAN et al., 2011; MACKENZIE, 2012; WARD et al., 2018; ZHANG et al., 2020; THAPA & DIEDRICH, 2023). Não são raras as situações em que medidas de proteção, como por exemplo a restrição de uso de recursos naturais por comunidades locais, resultam em conflitos socioambientais em APs (GARCÍA-FRAPOLLI et al., 2018; DE POURCQ et al., 2019). Assim, as relações de custo-benefício resultantes da criação, gestão e objetivos das APs são complexas, pois envolvem diferentes atores sociais, como, comunidades locais, visitantes e turistas, empresários e comerciantes, cada um trazendo diferentes perspectivas (PEARCE et al., 2006; HANLEY & BARBIER, 2009; SALA & GIAKOUMI, 2018; PICONE et al., 2020; THAPA et al., 2022; RODRIGUES & ROUYER, 2023).

Nesses cenários, os custos e benefícios resultantes das APs tendem a ser percebidos de forma desigual pelos diferentes grupos de pessoas que interagem com essas áreas e fazem uso destas, podendo ser essas percepções influenciadas por fatores socioeconômicos e pelas experiências de uso com o ambiente (MACKENZIE, 2012; TUAN, 2012; OLDEKOP et al., 2016; WARD et al., 2018; WOODHOUSE et al., 2018; CEBRIÁN-PIQUERAS et al., 2020; GULTE et al., 2023). Dessa forma, para que as APs sejam eficientes em promover o desenvolvimento sustentável, é preciso considerar as diversas percepções dos custos e benefícios que ocorrem e compreender os fatores que podem explicar essas diferentes percepções.

Entretanto, apesar da importância de estudos que tratem das múltiplas perspectivas das relações custo-benefício de APs, muitos focam exclusivamente nos prejuízos ou nos ganhos para determinados perfis de usuários ou perspectivas econômicas (GAINES et al., 2010; FERRARO & HANAUER, 2014; DAVIS et al., 2019; GAMARRA et al., 2023). Portanto, há uma lacuna de conhecimentos sobre como os custos e os benefícios de uma AP afetam, simultaneamente, os diferentes perfis de usuários e quais os principais fatores que explicam as percepções. Assim, esta pesquisa busca conhecer os fatores que explicam as percepções de custos e benefícios da conservação entre os diferentes perfis de usuários da Área de Proteção Ambiental Costa dos Corais, que é a maior Área Marinha Protegida do Brasil.

# 2. REVISÃO DA LITERATURA

## 2.1 Conservação ambiental e desenvolvimento sustentável

A degradação ambiental exerce grande pressão sobre os modos de vida atuais, afetando as populações de diversas maneiras, desde a escassez de recursos naturais até o aumento de desastres naturais e mudanças climáticas. Além disso, esses impactos não se restringem apenas ao presente, mas comprometem a qualidade de vida das gerações futuras (KUHLMAN & FARRINGTON, 2010; AYE, 2019; POOJA, 2023). Ao longo dos últimos séculos, a ideia de que a natureza é um bem a ser dominado pela humanidade gerou impactos ambientais alarmantes e de efeitos duradouros, como o desmatamento acelerado, poluição dos oceanos, a perda da biodiversidade e o esgotamento de recursos naturais não renováveis, essenciais para a manutenção ambiental (ZIMMERMAN, 2004; KUHLMAN & FARRINGTON, 2010; CLAYTON et al., 2013; LOREAU, 2014; MACE, 2014; ISLAM, 2024).

Dessa forma, para mitigar esses danos e promover um equilíbrio entre o desenvolvimento socioeconômico e proteção ambiental, surge a conservação ambiental como uma abordagem multidisciplinar. A conservação não envolve apenas a biologia e ecologia, mas também aspectos sociais, econômicos e culturais, buscando proteger o meio ambiente por seu valor intrínseco e promover uma relação mais harmoniosa entre a sociedade e a natureza (KUHLMAN & FARRINGTON, 2010; PRETTY, 2011; WOOD & DECLERCK, 2015; ISLAM, 2024). Com isso, para que o desenvolvimento sustentável seja efetivo, ele precisa estar alinhado à conservação ambiental, integrando a manutenção dos ecossistemas e seus serviços, a proteção da biodiversidade o uso responsável dos recursos naturais, além da promoção do bem-estar humano e justiça social (WOOD & DECLERCK, 2015; KETSCHAU, 2017; TONG, 2024).

A destruição de ecossistemas e sua biodiversidade afeta diretamente os serviços ambientais essenciais, como a regulação do clima, abastecimento de água, segurança alimentar e bem-estar humano (PRETTY, 2011; CLAYTON et al., 2013; ACHEAMPONG & OPOKU, 2023; UMAR et al., 2024). Esses serviços são fundamentais para a prosperidade a longo prazo da sociedade. Segundo Kuhlman e Farrington (2010), o desenvolvimento sustentável pode ser interpretado por três dimensões principais: desenvolvimento econômico, desenvolvimento social e proteção ambiental. Contudo, a desigualdade social e o acesso desigual aos recursos naturais reforçam desafios que se opõem ao desenvolvimento sustentável.

A disparidade no consumo de recursos e impactos ambientais entre países desenvolvidos e em desenvolvimento são evidentes, refletindo desigualdades socioeconômicas que comprometem a sustentabilidade (BOILLAT et al., 2018; FENG et al., 2023). Países industrializados, ricos em produtos naturais e com alto Produto Interno Bruto (PIB) apresentam níveis de consumo e degradação ambiental consideravelmente mais elevados do que países do Sul Global, além de exportarem seus impactos ambientais derivados do consumo para nações menos desenvolvidas, contribuindo para a degradação ambiental e suprimindo oportunidades de consumo de recursos nos países explorados (JORGENSON et al., 2009; BOILLAT et al., 2018; CUMMING & VON CRAMON-TAUBADEL, 2018; ACHEAMPONG & OPOKU, 2023; FENG et al., 2023).

Embora a Curva Ambiental de Kuznets aponte que a degradação ambiental tende a diminuir à medida que a renda *per capita* aumenta, essa hipótese não se aplica uniformemente, especialmente em países em desenvolvimento, que frequentemente carecem de recursos e instituições para mitigar os impactos ambientais, que eventualmente comprometem o desenvolvimento econômico (DINDA, 2004; STERN, 2017; SIRAG et al., 2018; CAHYADIN et al., 2021; ACHEAMPONG & OPOKU, 2023; FENG et al., 2023). Essa lógica de desigualdade também se aplica em uma escala mais regional, como no Brasil, onde comunidades tradicionais e populações vulneráveis frequentemente arcam com os maiores custos ambientais e sociais da exploração de recursos naturais (KALTENBORN et al., 2017; QIAN et al., 2018).

Povos tradicionais que historicamente mantêm modos de vida sustentáveis e dependem diretamente dos recursos naturais, sofrem diretamente com os impactos ambientais, sendo expostos a conflitos sociais e políticos em razão ao uso dos recursos naturais, além de serem frequentemente deslocados ou terem seus territórios degradados por atividades econômicas de grande impacto ambiental (CLAYTON et al., 2013; KALTENBORN et al., 2017; ANAYA & ESPÍRITO-SANTO, 2018; QIAN et al., 2018; SCHEIDEL et al., 2023). A sustentabilidade no Brasil, portanto, depende do reconhecimento dessas desigualdades e da implementação de estratégias que conciliam a conservação ambiental com a justiça social e a valorização dos modos de vida de comunidades tradicionais e seus conhecimentos (PRETTY, 2011; ANAYA & ESPÍRITO-SANTO, 2018; TONG, 2024).

Nesse sentido, integrar a conservação ambiental ao desenvolvimento econômico e social de forma justa é indispensável para garantir a sustentabilidade a longo prazo. As políticas públicas precisam considerar as variações regionais e as diferentes percepções sobre a natureza.

Estratégias como o ecoturismo e ações de educação ambiental podem ser eficazes para ampliar os benefícios ambientais e econômicos para as comunidades locais, ao mesmo tempo que promovem a conservação ambiental (STEM et al., 2003; HUNT et al., 2015; BOCA & SARAÇLI, 2019; LIOBIKIENĖ & POŠKUS, 2019; ARDOIN et al.,2020).

## 2.2 Áreas Protegidas

No século XVIII, com o Iluminismo e a Revolução industrial, os recursos naturais passaram a ser mais explorados e os impactos ambientais tornaram-se mais evidentes. Tal acontecimento impulsionou o fortalecimento e a visibilidade da abordagem de conservação ambiental. Dessa forma, a intenção em preservar as paisagens de beleza cênica e a biodiversidade culminou na criação do Parque Nacional de Yellowstone em 1872 nos Estados Unidos da América, sendo este o primeiro parque nacional do mundo, marcando o início da história das Áreas Protegidas (APs) (HEINEN, 2012; TOZZO & MARCHI, 2014). A partir desta iniciativa, surgiram outras áreas protegidas, ampliando as preocupações com o meio ambiente.

Já a partir do século XX, questões como a conservação ambiental e a consolidação das APs têm sido cada vez mais pautadas no objetivo de se criar estratégias que promovam o desenvolvimento sustentável e a proteção do patrimônio natural mundial (MEDEIROS et al, 2004; MACE, 2014; WATSON et al., 2014). A União Internacional para a Conservação da Natureza (IUCN) define as APs como “espaços geográficos claramente definidos, reconhecidos, dedicados e geridos, através de meios legais ou outros meios eficazes, para alcançar a conservação a longo prazo da natureza com serviços ecossistêmicos e valores culturais associados” (DUDLEY, 2008). Nesse contexto, as APs são ferramentas que podem conciliar a conservação ambiental com o uso sustentável dos recursos naturais, sendo importantes estratégias para incluir as comunidades locais na gestão do território e promover o bem-estar social e econômico das populações que vivem nessas regiões (CALDECOTT & JEPSON, 2014; WATSON et al., 2014; MCNEELY, 2020; DA ROCHA et al., 2025).

Atualmente, as APs estão distribuídas globalmente, cobrindo aproximadamente 15% do território terrestre e 7% do marinho (WATSON et al., 2014; VISCONTI et al., 2019). No entanto, esses números ainda estão abaixo da Meta 30x30 do Kunming-Montreal Global Biodiversity Framework, que busca proteger 30% de áreas terrestres, águas doce e oceanos até 2030 (Secretariat of the Convention on Biological Diversity, 2022). Além disso, a distribuição

e gestão das APs não é homogênea. Muitas são geridas de forma desigual e estão em áreas de difícil acesso, com poucos conflitos de uso, enquanto ecossistemas altamente ameaçados se encontram desprotegidos (MAMMIDES et al., 2021). Essa desigualdade também pode ser observada no Brasil, onde apesar do país possuir uma das maiores redes de APs do mundo, grande parte dessas áreas se concentram na Amazônia, enquanto biomas altamente ameaçados e degradados, como o Cerrado, a Mata Atlântica e a Caatinga, têm uma cobertura de proteção muito menor (BERNARD et al., 2014; CAMPOS et al., 2016; CANTINHO et al., 2021; TEIXEIRA et al., 2021; VIEIRA et al., 2022).

No Brasil as APs são regulamentadas principalmente pelo Sistema Nacional de Unidades de Conservação (SNUC; Brasil, Lei 9.985/2000) e classificadas em dois grandes grupos, sendo estes as Unidades de Conservação (UCs) de Proteção Integral, que visam à preservação da natureza e permitem apenas o uso indireto dos recursos naturais, e as UCs de Uso Sustentável, que permitem atividades humanas compatíveis com a conservação, com exploração do ambiente sem comprometer a perenidade dos recursos naturais renováveis e dos processos ecológicos. No grupo de UCs de Proteção Integral temos: Estação Ecológica; Reserva Biológica; Parque Nacional; Monumento Natural; Refúgio de Vida Silvestre; Reservas Particulares do Patrimônio Natural. Já dentre as UCs de Uso Sustentável se encontram as categorias de: Área de Proteção Ambiental (APA); Área de Relevante Interesse Ecológico; Floresta Nacional; Reserva Extrativista; Reserva de Fauna; Reserva de Desenvolvimento Sustentável.

No cenário desigual que as APs enfrentam, principalmente as de Uso Sustentável, a gestão dessas áreas ainda lida com pressões associadas à conflitos de interesse sobre uso dos recursos naturais, especialmente em regiões de forte pressão econômica (JEPSON et al., 2017; JONES et al., 2022; FISHER et al., 2023; DA ROCHA et al., 2025). Esses conflitos são ainda mais intensos quando populações locais dependem desses recursos para sua subsistência. Além da participação das comunidades locais, esse grupo de APs precisam de investimentos financeiros para infraestrutura e fiscalização, apoio político e público, programas de sensibilização ambiental e estratégias eficientes para mitigar conflitos e garantir seu papel frente à sustentabilidade a longo prazo (CALDECOTT & JEPSON, 2014; KOLAHI et al., 2012; JEPSON et al., 2017; JONES et al., 2022). Com isso, para que a implementação das APs de Uso Sustentável seja efetiva, é indispensável que se evidenciem os benefícios diretos e indiretos dessas áreas, tanto para a conservação ambiental quanto para o desenvolvimento sustentável (GAMARRA et al., 2019b).

Instrumentos como o Plano de Manejo, que estabelece diretrizes e ações específicas para cada área, e os conselhos gestores, que promovem a participação de comunidades locais e outros atores na tomada de decisões, são fundamentais para garantir que essas áreas sejam administradas de forma equilibrada e democrática e para evidenciar os benefícios associados a estas (BRAGAGNOLO et al., 2016; DA ROCHA et al., 2025). Dessa forma, a participação ativa da sociedade é essencial para fortalecer a governança dessas APs, além de contribuir para a valorização das comunidades tradicionais e para o desenvolvimento de benefícios sociais, como o turismo sustentável, que pode gerar renda e incentivar a conservação ambiental (ESFANDIAR et al., 2022).

No entanto, apesar de todos benéficos das APs, essas também podem gerar impactos negativos se não forem bem planejadas e implementadas. A exemplo, restrições no uso dos recursos naturais podem acentuar desigualdades socioeconômicas, reforçando armadilhas de pobreza e intensificando conflitos entre diferentes grupos de usuários (ADAMS & HUTTON, 2007; BROCKINGTON & WILKIE, 2015; BRAGAGNOLO et al., 2016). Dessa forma, garantir que os benefícios das APs sejam distribuídos igualitariamente entre os diferentes atores sociais que fazem uso dessas áreas, e que os direitos e necessidades das populações locais sejam respeitados é um desafio complexo, mas que precisa ser superado para a efetividade das APs.

## 2.3 Custos e benefícios de Áreas Protegidas

As APs quando bem geridas e manejadas pela perspectiva de uso sustentável, podem promover uma série de benefícios socioambientais. Os benefícios das APs são amplamente documentados na literatura, principalmente sob o aspecto ecológico, incluindo a proteção da biodiversidade, dos ecossistemas e dos seus serviços de regulação (DUDLEY et al., 2010; BERNARD et al., 2014). Essas áreas representam ambientes de relevância econômica ao impulsionar atividades sustentáveis, como o ecoturismo, a pesca artesanal e o extrativismo florestal, que geram empregos e fomenta a economia local (WATSON et al., 2014; MCNEELY, 2020; THAPA et al., 2022; GAMARRA et al., 2023). Além disso, as APs possuem um importante papel na manutenção dos modos de vida tradicionais e no fortalecimento da identidade cultural das comunidades tradicionais (LANGTON et al., 2014; GAMARRA et al., 2023).

Por outro lado, a implementação das APs também pode levar a custos significativos, que podem afetar a inclusão social e o desenvolvimento sustentável. A imposição de restrições

ao uso do território, por exemplo, é uma estratégia que gera benefícios ambientais, mas que por outro lado, pode desencadear conflitos locais, resultar na desapropriação de terras, levar à marginalização das comunidades tradicionais e comprometer a segurança alimentar e os meios de subsistência de populações tradicionais (COAD et al., 2008; ANAYA & ESPÍRITO-SANTO, 2018). Além disso, o alto custo de manutenção das APs, incluindo investimentos em fiscalização, infraestrutura e gestão participativa, pode representar custos financeiros para a gestão dessas áreas (CALDECOTT & JEPSON, 2014; CRAIGIE & PRESSEY, 2022).

Neste contexto, as relações custo-benefício das APs podem variar significativamente entre os diferentes tipos de atores sociais que interagem com esses territórios. Para comunidades locais, os benefícios podem incluir a manutenção dos recursos naturais, garantindo a renovação e uso sustentável destes, a participação em programas de manejo sustentável e geração de renda através de atividades econômicas sustentáveis (MACKENZIE, 2012; OLDEKOP et al., 2016; THAPA et al., 2022). No entanto, quando as APs são implementadas em um modelo de proteção integral, esses grupos podem sofrer com restrições de acesso a territórios historicamente ocupados (ANAYA & ESPÍRITO-SANTO, 2018). Contudo, ainda há lacunas na mensuração desses benefícios e na integração dos custos associados em modelos tradicionais de gestão (DIXON & SHERMAN, 1990; CALDECOTT & JEPSON, 2014; WATSON et al., 2014; DAVIS et al., 2019).

No aspecto social e cultural, o apoio às APs depende da forma como essas áreas são geridas e ao grau de participação das populações locais em sua governança. Além disso, políticas de gestão inclusivas potencializam os benefícios gerados por essas áreas, fortalecendo sua valorização como instrumentos de bem-estar coletivo (ANDRADE & RHODES, 2012; BRAGAGNOLO et al., 2016; WARD et al., 2018; DE OLIVEIRA JÚNIOR et al., 2021). No entanto, quando a governança é excludente e negligente, as APs podem intensificar desigualdades sociais, conflitos territoriais e afetar desproporcionalmente atores sociais em maior vulnerabilidade social, intensificando os custos socioeconômicos associados a estas áreas (OLDEKOP et al., 2016; BOILLAT et al., 2018; WARD et al., 2018; WOODHOUSE et al., 2018).

Essas dinâmicas conflitantes tornam a gestão e aceitação das APs um desafio complexo, exigindo abordagens que conciliam a conservação ambiental com a justiça social. Com isso, é importante que os custos e benefícios dessas áreas sejam debatidos de maneira ampla e inclusiva, considerando a diversidade de atores sociais envolvidos e suas distintas formas de interação com esses territórios. Contudo, ainda existem lacunas científicas que precisam ser

exploradas, uma vez que a maioria dos estudos se concentra nos aspectos ecológicos e econômicos das APs, enquanto efeitos sociais e culturais são pouco trabalhados (NAIDOO & RICKETTS, 2006; GAINES et al., 2010; FERRARO & HANAUER, 2014; DAVIS et al., 2019).

## 2.4 Percepção e participação social nas Áreas Protegidas

Tendo em vista que o desenvolvimento sustentável é fundamental para se encontrar soluções duradouras para os problemas ambientais, antes é preciso compreender o papel da sociedade perante o meio ambiente (HTAY et al., 2022). Diferentes processos psicológicos e sociais se relacionam e influenciam as ações humanas sobre a conservação ambiental, e a percepção é a base desse processo. A percepção é o processo de construir representações sobre algo a partir da captação de estímulos pelos sentidos e da interpretação desses estímulos com base em referências internas e externas (TUAN, 2012; GIBSON, 2014). Nesse sentido, a percepção é capaz de influenciar como as pessoas interpretam e reagem às mudanças ambientais, além de poder determinar o nível de engajamento das pessoas na proteção ambiental (CEBRIÁN-PIQUERAS et al., 2020).

As percepções podem gerar impactos ambientais ou, ao contrário, incentivar o engajamento em ações sustentáveis. A maneira como uma pessoa enxerga e atribui significado ao ambiente depende de suas experiências vivenciadas e seus conhecimentos (HTUN et al., 2012; CEBRIÁN-PIQUERAS et al., 2020). Com o tempo, a percepção se transforma em opinião à medida que os indivíduos interpretam e avaliam as informações que absorvem. E as opiniões, quando consolidadas, dão origem às atitudes, que são predisposições relativamente estáveis para reagir de forma positiva ou negativa a determinado tema. As atitudes, por sua vez, influenciam diretamente o comportamento, determinando ações que podem apoiar ou comprometer a conservação ambiental (TUAN, 2012; BOSNJAK et al., 2020).

A percepção não apenas reflete a relação das pessoas com o meio ambiente, mas também pode ser utilizada como um indicador de aceitação ou rejeição das medidas de conservação. Se a percepção sobre as APs for negativa, as chances de apoio às políticas ambientais também diminuem (PIETRZYK-KASZYŃSKA et al., 2012; BENNET, 2016; CIOCĂNEA et al., 2016). Nesse sentido, a comunicação e a sensibilização ambiental tornam-se ferramentas fundamentais para reverter percepções equivocadas e fortalecer o engajamento ambiental

(FERNANDES et al., 2004; BRAGAGNOLO et al., 2016; BOCA & SARAÇLI, 2019; LIOBIKIENĖ & POŠKUS, 2019).

O engajamento ambiental é particularmente importante no contexto das APs por serem territórios com dinâmicas socioambientais complexas, cuja efetividade na conservação ambiental depende do suporte político e do apoio público. Entretanto, a gestão dessas áreas, ou ausência dela, pode fazer com que os custos e benefícios sejam percebidos e distribuídos de forma desigual entre os diferentes atores sociais que fazem uso desses espaços (MACKENZIE, 2012; OLDEKOP et al., 2016). Enquanto alguns percebem as APs como uma oportunidade para o desenvolvimento sustentável e para a melhoria do bem-estar local, outros as veem como uma restrição às suas atividades econômicas e culturais (MACKENZIE 2012; NSUKWINI & BOB, 2019). Essa diversidade de percepções reforça a importância da participação social na gestão ambiental, uma vez que processos inclusivos e transparentes podem reduzir conflitos socioambientais (VODOUHÊ et al.,2010; CIOCĂNEA et al., 2016; MASUD et al., 2022).

Dessa forma, conselhos gestores, consultas públicas e mecanismos de gestão participativa são importantes estratégias em APs, principalmente por abrirem espaço para que diferentes atores sociais expressam suas percepções e sejam incluídos em tomadas de decisões. Além disso, tendo em vista que a conservação acontece de fato em nível local, também se faz necessário compreender a percepção das comunidades locais e das demais partes interessadas, levando em conta seus interesses e prioridades (VODOUHÊ et al.,2010; KUSUMAWATI & HUANG, 2015; GULTE et al., 2023). A eficácia de tal abordagem é corroborada por diferentes estudos, que mostram que a incorporação da percepção de comunidades locais na gestão de APs resulta em uma maior adesão às regras de conservação, redução de conflitos socioambientais e apoio à conservação (VODOUHÊ et al.,2010; MASUD et al., 2022; GULTE et al., 2023).

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**Perceptions of costs and benefits. Socioeconomic factors and user experiences shaping perceptions of Brazil's largest Marine Protected Area**

**Abstract:**
The establishment and maintenance of IUCN Category V Protected Areas (PAs) are essential for biodiversity conservation and sustainable development. However, these areas face challenges in implementing territorial management that effectively balances environmental conservation with the demands of various Category V PAs user groups. Perceptions of the costs and benefits of this areas tends to vary according to socioeconomic factors, such as income, education, and occupation, as well as usage experiences within these areas, including resource extraction or recreational visitation. This study investigated variations in cost-benefit perceptions among different user groups of the Costa dos Corais Environmental Protection Area (APCC), a Marine Protected Area (MPA) that plays a significant role in marine biodiversity conservation in Brazil and in the socioeconomic dynamics of its territory. The study's hypotheses were: (i) users in more vulnerable socioeconomic conditions tend to perceive the costs of APACC more strongly than its benefits; (ii) users whose primary connection to the area is associated with leisure demonstrate a more favorable perception, emphasizing benefits over costs. To test these hypotheses, structured questionnaire interviews were conducted with 300 people, 75 individuals for each APACC user group. Subsequently, the data were submitted to Cumulative Linkage Mixed Models (CLMM), fitting separate models for costs and benefits to analyze the influences of socioeconomic variables and user experience on the perception of costs and benefits. The results showed that users with greater socioeconomic vulnerability, such as fishers and residents with low family income, perceived more costs related to APACC, particularly territorial costs. In contrast, tourists and individual without formal education identified more benefits. These findings corroborate the hypotheses of the work and reinforce the need for management policies that integrate local socioeconomic demands, promote sustainable tourism and artisanal fishing, and adopt inclusive governance, aiming to reduce costs and maximize the benefits of Category V PAs, especially among traditional communities such as artisanal fishers, who are typically more impacted by the costs associated with MPAs.

**Key-words:** Socioenvironmental impacts. Environmental perception. Cost-benefit relations.

## 1. INTRODUCTION

Due to human actions and different forms of environmental impacts, environmental conservation has become vital for a lasting and sustainable future. In this scenario, Protected Areas (PAs) have been an important strategy for conserving biodiversity and natural ecosystems (WATSON et al., 2014; SCHLEICHER, 2018). These areas are designated to protect species, ecosystems, and landscapes (WATSON et al., 2014). Among the different PA categories established by the International Union for Conservation of Nature (IUCN), Category V (Protected Landscapes/Seascapes) allows for human occupation and sustainable use of natural resources, integrating conservation with local development (DUDLEY, 2008). In addition, they can help to strengthen traditional and local communities through the sustainable use of nature resources, supporting community-based tourism or other services that foster local socioeconomic development in conjunction with environmental conservation (BERNARD et al., 2014; WATSON et al., 2014).

However, PAs face numerous anthropogenic pressures and conflicts of interest between the goals of conservation, human well-being, and land use (LIU et al., 2010; OLDEKOP et al., 2016; QIAN et al., 2018; FRANÇA, 2019; ERASO, 2021). This is particularly relevant in PAs classified under IUCN Category V, such as Environmental Protection Areas (APAs) in Brazil, where multiple land uses coexist (BRASIL, 2000; DUDLEY, 2008). In this context, social participation decision-making in these areas is widely debated. While some approaches advocate for limiting human interaction within PAs (WILSHUSEN et al., 2002; WUERTHNER et al., 2015), others suggest that environmental conservation needs to be more inclusive, integrating relationships between PAs and the different social actors that use their territory (LIU et al., 2010; OLDEKOP et al., 2016; CARIÑO & FERRARI, 2021; GAMARRA et al., 2023).

The ties between people and PAs are based on the use of nature, either directly or indirectly. As a result, different social actors have varying ties to the costs and benefits defined by PAs, which can be understood through different perspectives, such as economic, social, and environmental (NAIDOO & ADAMOWICZ, 2005; NAIDOO & RICKETTS, 2006; MCSHANE et al., 2011; DE GROOT et al., 2013). This highlights the issue of the cost-benefit relationships of PAs. Among the benefits derived from Category V Marine Protected Areas (MPAs), various ecosystem services stand out, such as scenic landscape enjoyment, recreation, and tourism (RAYMOND et al., 2009);

improvement in the health and resilience of marine ecosystems (DOUVERE, 2008; WOOD et al., 2008; SALA & GIAKOUMI, 2018); promotion of scientific research in ecology (KATSANEVAKIS et al., 2017); and revenue and job generation through eco-tourism (SALA & GIAKOUMI, 2018). However, conservation benefits can also be seen as costs depending on the relationships of use and user profiles.

For instance, restrictions on direct use of natural resources, such as fishing, may generate environmental benefits but result in economic losses for local communities that directly depend on these resources for income and subsistence (ADAMS et al., 2004; WELLS & MCSHANE, 2004; SIMS, 2010; MACKENZIE, 2012; NSUKWINI & BOB, 2019). Such measures can lead to conflicts of interest and challenges in dealing with unregulated activities and resource use (BELSOY et al., 2012; ARIAS et al., 2015). A better understanding of how different social actors perceive the costs and benefits of MPAs can provide a foundation for more informed decision-making in territorial management, conflict mediation, and adjustment of conservation strategies.

Perception is a cognitive process through which individuals interpret and assign meaning to the environment around them, which can vary according to socioeconomic and cultural factors, experiences, beliefs and values (GIBSON, 1979; BERKES, 2012; TUAN, 2012). In the socio-environmental context, perceptions influence how people interact with nature and respond to environmental interventions, forming opinions and attitudes toward conservation (FERNANDES et al., 2004; PICKENS, 2005; TUAN, 2012). While attitudes, which are a relatively stable evaluative predispositions (AJZEN & FISHBEIN, 1970; TUAN, 2012), and behavior, which represents the concrete expression of perceptions and attitudes in actions (HEIMLICH & ARDOIN, 2008), perception is dynamic and sensitive to individual and collective experiences (FERNANDES et al., 2004).

This perception-based approach is particularly relevant in the context of PAs under IUCN Category V, where the costs and benefits of their existence are experienced and evaluated differently by different user profiles, with implications for the territorial management of these areas and for conservation policies (MACKENZIE, 2012; RODRÍGUEZ-RODRÍGUEZ, 2012; KARANTH & NEPAL, 2012; HTAY et al., 2022). While some groups of users predominantly perceive the environmental, socioeconomic, and cultural benefits of Category V PAs, others emphasize the restrictions and impacts on their livelihoods. For example, individuals with lower socioeconomic vulnerability, i.e., higher income and education levels, tend to recognize the broader

benefits of conservation for health, well-being, and the economy, assigning greater value to environmental protection (OLDEKOP et al., 2016). Additionally, groups geographically distant from protected areas may also emphasize potential benefits, including tourism and biodiversity protection (SIMS, 2010; GHOSH & GHOSH, 2019). In contrast, communities with more precarious socioeconomic conditions, especially those living in the vicinity of Category V PAs, often perceive the protected areas costs more intensely, such as restricted access and limitations on local economic activities (ANAYA & ESPÍRITO-SANTO, 2018).

Furthermore, the type of use experience directly influences the perception of costs and benefits in Category V PAs. People who seek these areas for leisure and recreation, as visitors and tourists, tend to have a more favorable perception of them, emphasizing the cultural, structural, and aesthetic benefits provided by these areas, such as trails, diving, sports, beach tourism, and local gastronomy (DIAZ-CHRISTIANSEN et al., 2016; BLANCO-SALAS et al., 2019; CAPARRÓS-MARTÍNEZ et al., 2022). Those with greater familiarity and interest in activities like ecotourism and wildlife observation show a more pronounced appreciation for environmental conservation (OCAMPO-PEÑUELA & WINTON, 2017; HAUSMANN et al., 2018). Understanding how different factors explain perceptions of costs and benefits among various social actors can contribute to the success of conservation policies and territorial management strategies for Category V PAs, as public support for conservation can reduce conflicts of interest (MACKENZIE, 2012; RODRÍGUEZ-RODRÍGUEZ, 2012).

Thus, we seek to answer the following question: how do perceptions of the costs and benefits of a Category V Protected Area vary according to socioeconomic profiles and use experiences? To this end, we focus on the Costa dos Corais Environmental Protection Area (APACC), a MPA located in the state of Alagoas, Brazil. We assume two hypotheses: i) users in more vulnerable socioeconomic situations (e.g., lower income, occupations related to resource use in the MPA, lower education levels, among others) tend to perceive the costs of the AMP more acutely than its benefits; ii) users whose primary connection with the area is leisure-related tend to have a more favorable perception, emphasizing benefits over costs.

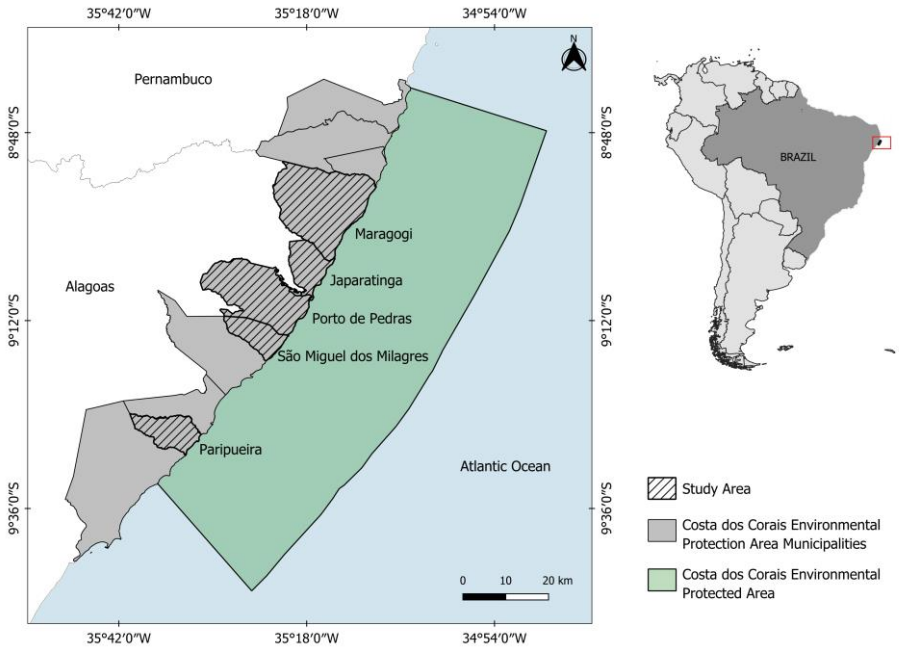
## 2. METHODOLOGY

### 2.1. Study area

The Costa dos Corais Environmental Protection Area (APACC) (9◦14’23.19"S and 35◦12’9.61"W) is one of the most important sustainable-use IUCN Category V PAs in Brazil, and the largest MPA in the country, covering approximately 413,000 hectares along the coast of Alagoas and Pernambuco, and about 120 km of beaches and mangroves (ICMBio). APACC has a great diversity of marine ecosystems, such as coral reefs, mangroves, and beaches, which provide habitat for a wide variety of species (ARAÚJO & BERNARD, 2016; PEREIRA et al., 2022). This environmental and biological wealth gives the PA a crucial role in the conservation of marine biodiversity in Brazil. In addition, APACC plays an important socioeconomic role in the region. Also, APACC have contributed to the strengthening of traditional and local communities, primarily through artisanal fishing and the promotion of community-based tourism (GERHARDINGER et al., 2009; ARAÚJO & BERNARD, 2016; GAMARRA et al., 2023).

Our study was conducted in five municipalities, selected from the 11 that make up the APACC (Figure 1). These municipalities include Paripueira (9°27'55"S and 35°33'8"W) in the South Region of APACC, São Miguel dos Milagres (9°15'54"S and 35°22'18"W) and Porto de Pedras (9°9'29" S and 35°17'46"W) in the Ecological Route region, and finally, Japaratinga (9°5'16"S and 35°15'33"W) and Maragogi (9°0'46"S and 35°13'17"W), located in a Tourism Pole region (DE OLIVEIRA JÚNIOR et al., 2021). These municipalities, located in the Alagoas portion of APACC, were chosen due to their shared characteristics, including a strong presence of tourism, which occurs in the region mainly due to the beaches, natural pools, community-based tourism, inns and hotels, rich gastronomy, and a wide variety of tours such as buggy rides, boat trips, and speedboat rides (GLASER et al., 2018; DE OLIVEIRA JÚNIOR et al., 2021).

**Figure 1- Costa dos Corais Environmental Protection Area and study area**.




Source: Author, 2025.

Besides tourism, artisanal fishing is also present in all five municipalities included in the study (DE OLIVEIRA JÚNIOR et al., 2021; GAMARRA et al., 2023). However, despite sharing these common activities, the intensity and characteristics of both tourism and fishing vary across the regions. The Tourism Polo stands out due the strong presence of tourists, with significant infrastructure supporting it, such as inns, hotels and restaurants. In contrast, the Ecological Route is characterized by community-based tourism and ecotourism. The South Region, on the other hand, exhibits limited tourism activities, where artisanal fishing remains the predominant economic activity.

## 2.2. Data collection

The sample used was non-random, quota-based. Interviews were conducted with four user groups of APACC: (1) artisanal fisher; (2) non-fishing local dweller; (3) tourism entrepreneurs and traders (which includes streets vendors, tour guides, commercial employees focused on tourism, hotels and restaurants); (4) tourists and visitors. For each region of the study area (South Region,

Ecological Route, Tourism Pole), 100 interviews were conducted, totaling 300, with 25 interviews per group per region (Table 1).

**Table 1- Number of interviewees per group and region of the study area.**

| Interviewee Group | South Region | Ecological Route | Tourism Pole |
|---|---|---|---|
| Artisanal fisher | 25 | 25 | 25 |
| Non-fishing local dweller | 25 | 25 | 25 |
| Tourism entrepreneurs and traders | 25 | 25 | 25 |
| Tourists and visitors | 25 | 25 | 25 |
| Total | 100 | 100 | 100 |

Source: Author, 2025.

The interviews took place between March and April 2024, and the respondents were approached accidentally and invited to participate in the research. Initially, participants were informed about the research objectives and invited to complete a structured questionnaire and sign the Informed Consent Form (ICF), which emphasized that the information provided by the participants would be kept confidential, in accordance with the model approved by Ethics Committee of Federal University of Alagoas (CEP: 6.624.270). The research was registered with the Biodiversity Authorization and Information System (SISBio: 92248-1).

The first section of the questionnaire (See Supplementary Material – APPENDIX A) contained questions for the socioeconomic characterization of the respondents (e.g., age, gender, education, place of residence, profession and/or main occupation, income). The second section included questions to identify the respondents' usage experiences in APACC (e.g., frequency of visits, purpose of use, interest in appreciating natural beauty, knowledge about the environmental and economic services of APACC). The region where the interview took place was also considered a variable in usage experience. Finally, the last section of the questionnaire presented statements highlighting potential costs and benefits of a PA, where respondents indicated whether they agreed or disagreed with the statements, using a Likert scale ranging from 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree". Both costs and benefits were selected based on economic, sociocultural, ecological, and territorial management aspects (Table 2).

**Table 2. Aspects of each cost and benefit category covered in the interviews.**

| Cost and Benefit Categories | Covered aspects |
|---|---|
| **Economic** | Economic costs and benefits of APACC on local sources of income and livelihoods, cost of living, employment opportunities and economic growth of the region. |
| **Sociocultural** | APACC costs and benefits on the local lifestyle and traditions, appreciation of local culture, needs of the local community, contemplation of nature and well-being. |
| **Ecological** | Costs and benefits of APACC on nature conservation and local landscape, influence of tourism on the local environment, local pollution and environmental awareness. |
| **Territorial management** | APACC costs and benefits on access to the sea and other places, rights of local communities, infrastructure for recreation and comfort and local conflicts. |

Source: Author, 2025.

To try to reduce the potential influence of response bias, that is, the tendency to agree with statements presented by the interviewer, the questionnaire was designed to intersperse statements in positive and negative form. For example, while some items emphasized the benefits of the APACC (e.g., "Environmental protection helps generate income for fishing communities and local residents"), others highlighted potential costs (e.g., "Environmental protection in this region causes harm to fishing communities and local residents"). Additionally, contradictory statements such as "Environmental protection does not help reduce waste and local pollution" were included to balance the scale and encourage respondents to think more critically about their answers.

## 2.3. Data analysis

### 2.3.1. Diagnostic procedures and data preparation

To ensure the adequacy of the statistical tests applied to the data, a normality analysis of the ordinal variable "perception of costs and benefits" was conducted. This variable was characterized by the Likert scale value attributed by each interviewee for each cost and benefit statement present in the questionnaire (APPENDIX A). Also, because this variable was composed of statements that emphasize both the benefits (e.g., "Environmental protection helps generate income for fishing communities and local residents") and costs (e.g., "Environmental protection in this region causes harm to fishing communities and local residents") of PA depending on the sentence structure, the same Likert value scale could not be used for both models (costs and benefits), thus, the Likert scale was recoded as follows: i) Values 1 and 2 were assigned to responses representing perceptions favorable to costs; ii) Values 4 and 5 were assigned to

perceptions favoring benefits; and the value 3 remained the same, representing responses “neither agree or disagree”.

At first, we ran the Anderson-Darling test to see if the data followed a normal distribution. The data exhibited a non-normal distribution ($A = 1145.2$, $p < 2.2e\text{-}16$). The test revealed a very low p-value ($p < 2.2e\text{-}16$), which is below the significance level of 0.05. This indicates that responses are not uniformly distributed across categories, meaning that most perceptions tend to concentrate in specific categories of the scale. Next, a Chi-Square test was used to check if the distribution of responses in the Likert scale was uniform. Since the data did not show a normal or uniform distribution, non-parametric statistical methods were employed. In this context, we applied the Kruskal-Wallis test to compare differences in perceptions among the respondent groups. The Kruskal-Wallis test yielded a result significantly than the 0.05 threshold ($p = 5.9999e\text{-}08$), indicating statistically significant differences between groups, meaning that perceptions vary according to the respondents’ category of belonging.

In addition, to assess the presence of collinearity between the predictor variables used in the study (Table 3), the Variance Inflation Factor (VIF) analysis was performed, since collinearity between variables can compromise and reduce the accuracy of the model. Initially, two VIF models were adjusted, one containing the socioeconomic variables and other containing the user experience variables. For each set of variables, we calculated the VIF values and established a threshold for identifying severe collinearity, adopting the criterion of $VIF > 10$ as indicative of excessive collinearity.

**Table 3. Predictor variables description.**

| CATEGORY | PREDICTOR VARIABLES |
|---|---|
| **Socioeconomic** | Interviewee Group; Age; Gender; Education; Local Economy; Personal Economy; Occupation; Monthly Income; Family Income. |
| **User experiences** | Interview Region; Knowledge about local environmental protection; Main use of APACC; Knowledge about local environmental changes; Participation in courses on local ecological knowledge; Use of infrastructures intended for leisure; Need for improvements in local infrastructures; Conflicts with other APACC users; Experienced any unpleasant situations using local nature; Experienced pleasant situations using local nature |

Source: Author, 2025.

In the VIF model that evaluated the socioeconomic variables, it was observed that the variables ‘occupation’ (VIF = 70.60) and ‘monthly income’ (VIF = 21.32) presented extremely high values, indicating strong collinearity. Consequently, these variables were excluded from subsequent analyses. The other socioeconomic variables presented acceptable VIF values, ranging from 1.08 to 3.37. Regarding the model that evaluated the user experiences variables (Table 3), the VIF values were all lower than 1.40, suggesting the absence of severe collinearity between these variables. In addition to the VIF, collinearity between the categorical variables was verified using Cramér’s V coefficient, which allows to identify significant associations between pairs of qualitative variables. High coefficients ($\geq 0.5$) were identified for the combinations ‘Interviewee Group’ vs. ‘Occupation’ (V = 0.64) and ‘Monthly income’ vs. ‘Family income’ (V = 0.51), reinforcing the exclusion of ‘Occupation’ and ‘Monthly income’ variables, already indicated by the VIF analysis. All analyses were conducted in the RStudio 4.3.2 environment.

### 2.3.2. Cumulative Link Mixed Models analysis

To investigate the factors that influence perceptions of the costs and benefits of APACC, we used Cumulative Link Mixed Models (CLMM), testing the effects of socioeconomic variables and usage experiences on perceptions of costs and benefits. We choice CLMM for its robustness in handling ordinal response variables, such as the Likert scale used in this study. CLMM allows for handling data dependency and incorporating random effects, given that each respondent provided multiple perception assessments (CHRISTENSEN, 2018). It is noteworthy that when dealing with explanatory variables with multiple levels, the model uses one level as a base to calculate the coefficients for other levels in comparison to this baseline category. This approach simplifies the interpretation of results by avoiding redundancy. The models were fitted using the clmm() function from the ordinal package in RSudio version 4.3.2, with the maximum likelihood configuration via the link function (link = “logit”). The response variable was the perception of costs and benefits, obtained on a five-point ordinal scale (1 to 5).

To test the first hypothesis “users in more vulnerable socioeconomic situations tend to perceive the costs of the Protected Area more acutely than its benefits”, the model was specified with the response variable Perception as a function of the predictors respondent group, age, gender, education, local economy, personal economy, occupation, monthly income, family income, and a

random effect for the respondents (ID). The random effect was used to capture variations in perceptions not explained by the predictors and reflects individual differences among respondents. This allowed modeling variability among individuals, recognizing that responses may be influenced by unobserved factors in addition to fixed variables. The model specification is expressed by Equation 1.

$$Perception \sim Interviewee\ Group + Age + Gender + Education + Local\ Economy + Personal\ Economy + Occupation + Monthly\ Income + Family\ Income + (1 \mid ID) \quad \text{Eq.1}$$

To test the second hypothesis "users whose primary connection with the area is leisure-related tend to have a more favorable perception, emphasizing benefits over costs", the Perception variable was used as the response variable, with usage experience as the predictor variable. The respondent's ID was also included as a random effect. The model specification is expressed by Equation 2.

$$Perception \sim Interview\ Region + Knowledge\ about\ local\ environmental\ protection + Main\ use\ of\ APACC + Knowledge\ about\ local\ environmental\ changes + Participation\ in\ courses\ on\ local\ ecological\ knowledge + Use\ of\ infrastructures\ intended\ for\ leisure + Need\ for\ improvements\ in\ local\ infrastructures + Conflicts\ with\ other\ APACC\ users + Experienced\ any\ unpleasant\ situations\ using\ local\ nature + Experienced\ pleasant\ situations\ using\ local\ nature + (1 \mid ID) \quad \text{Eq.2}$$

The models were fitted using the clmm.control() function, with a maximum number of 1000 interactions and a gradient tolerance of 1x10-4. We used $\alpha = 0.05$ for statistical significance. Additionally, the models were simplified to their most parsimonious form using a stepwise procedure. When significant predictor variables had more than one level, multiple comparison analyses were conducted to identify differences among groups. Multiple comparison analyses were performed using marginal means estimation with adjustments for multiple comparisons. The emmeans () function from the emmeans package was used to calculate adjusted marginal means. The formulation uses for pairwise comparisons followed the structed of Equation 3.

$$emmeans(modelo, pairwise \sim Variável\ Resposta \mid Variável\ Preditora, mode = "prob") \quad \text{Eq.3}$$

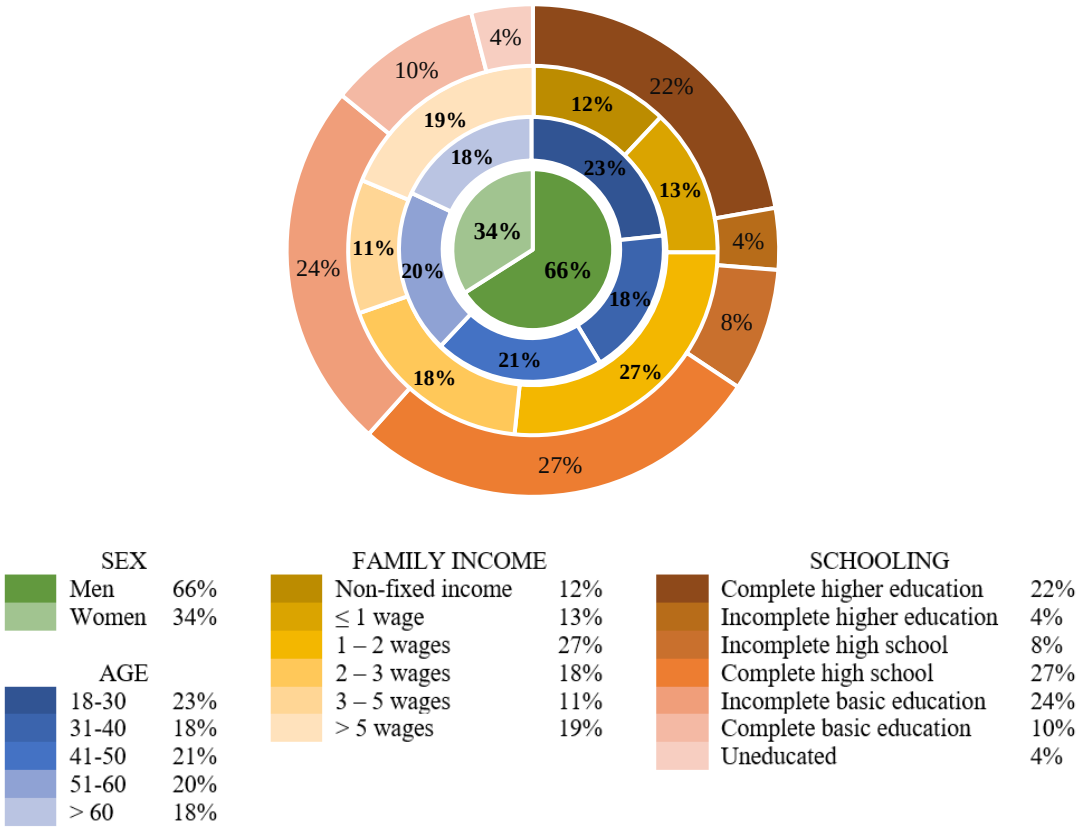
Statistical analysis was performed in RStudio, and additional analyses were conducted in spreadsheets for data tabulation and organization.

## 3. RESULTS

### 3.1. Socioeconomic Characterization

The sample was composed mostly by men (66%), while women represented 34% of the interviewees (Figure 2). Regarding age range, the interviewees were relatively well distributed among the age groups, with a greater concentration in the 18 to 30 age range (23%) and between 41 to 50 (21%), followed by those between 51 and 60 years old (20%). Family income varied among different categories, being more frequent among those who family' earn between one and two minimum wages (27%), above five minimum wages (19%) and between two and three minimum wages (18%). Individuals without a fixed family income corresponded 12% of the sample, followed by those with family income below one minimum wage (13%). Regarding education, the interviewees had different levels of education. The most representative category was that of individuals with complete high school (27%), followed by those with incomplete basic education (24%) and complete higher education (22%). The lowest proportion was observed among those without formal schooling (4%) and with incomplete higher education (4%).

**Figure 2. Socioeconomic characterization – Percentage of participants by socioeconomic variable.**




Source: Author, 2025.

### 3.2. Characterization of user experiences

The interview region variable showed a balanced distribution among respondents due to the methodology used in this study, where 25 individuals from each user group were interviewed in each region. Recreation and leisure were the primary uses of APACC among respondents, mentioned by 62% of participants ($\bar{x}$ = 15.5%, SD = 8.59), with greater emphasis among tourists (24.7%) and non-fisher local dweller (20.3%). Knowledge about local environmental protection was also a relevant aspect, with 61.7% of respondents reporting familiarity with the topic ($\bar{x}$ = 15.4%, SD = 5.6). Among the respondent groups, artisanal fishers (20.3) and tourism entrepreneurs (18.3%) had the highest percentages of affirmative responses.

Perceptions of environmental changes in the region over the years were reported by 63.7% of respondents ($\bar{x}$ = 15.9%, SD = 6.9), being most prominent among artisanal fishers (21.3%) and non-fishing local dweller (19.3%), while tourists had the lowest recognition rate (5.3%). The need for improvements in APACC's infrastructure was also a key point, highlighted by 85.7% of respondents ($\bar{x}$ = 21.4%, SD = 2.4), with the highest emphasis among tourism entrepreneurs (23.3%), non-fishing local dweller (22%), and artisanal fishers (22.7%).

Participation in formal and informal environmental education activities was low, with only 33.3% of respondents reporting involvement in ecological knowledge learning sessions ($\bar{x}$ = 8.3%, SD = 4.3). Finally, 80% of respondents reported experiencing something positive and enjoyable when engaging with the local environment ($\bar{x}$ = 20%, SD = 1.9), while negative experiences were mentioned by 23.7% ($\bar{x}$ = 5.9%, SD = 3.7), and conflicts among PA users were reported by 14.3% of respondents ($\bar{x}$ = 3.6%, SD = 2.3). It should be noted that the percentage of each user experience variable for each group of respondents was calculated based on a total of 75 individuals per group, representing 25% of the sample in each category of variables, and the total sample size of the study was 300 respondents.

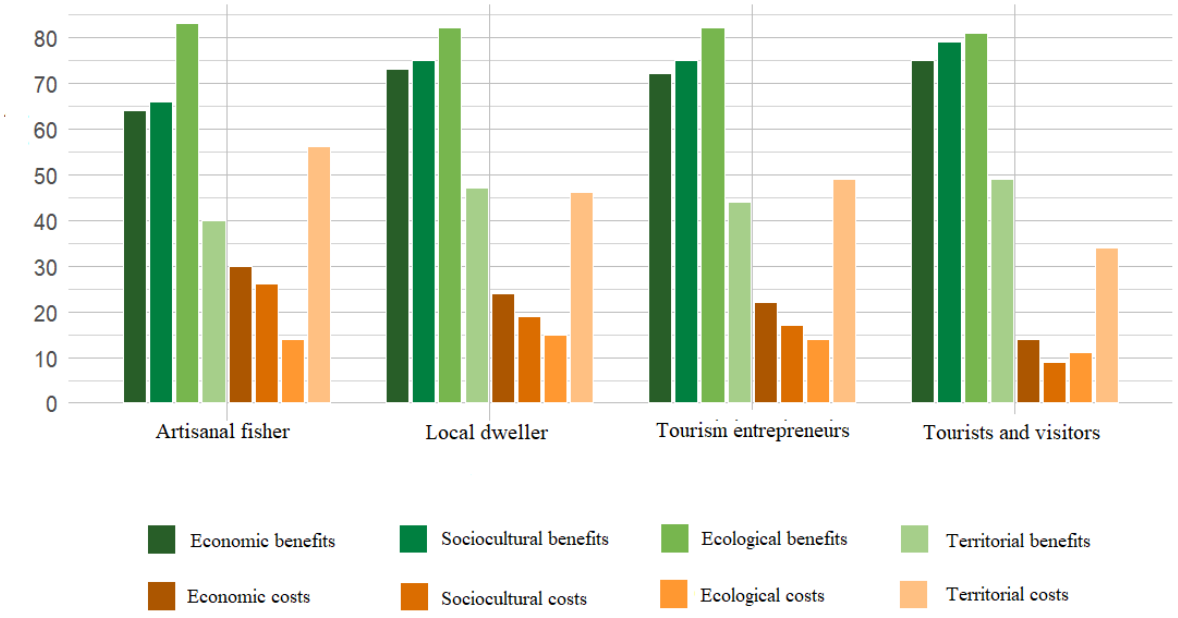
### 3.3. Perception of costs and benefits by dimension (economic, ecological, sociocultural, territorial)

Overall, benefits were widely recognized across all analyzed dimensions – economic, sociocultural, ecological, and territorial – while costs were more intensely perceived by fishers and local residents (Figure 3). In the economic dimension, benefits were broadly perceived by all groups, ranging from 64% among artisanal fishers to 75% among tourists. Tourism entrepreneurs and non-fisher local dweller had similar perceptions (72% and 73%, respectively). In contrast, economic costs were reported with lower intensity, being highest among fishers (30%) and non-fisher local dweller (24%), while tourists reported the lowest costs (14%).

In the sociocultural dimension, the perception of benefits was high, exceeding 66% in all respondent groups, with tourists recognizing the most benefits (79%), followed by tourism entrepreneurs and non-fisher local dweller. Sociocultural costs were perceived less frequently, being most significant among fishers (26%). In ecological dimension, benefits were the most recognized across all dimensions, ranging from 81% (tourists) to 83% (fishers and tourism

entrepreneurs). Conversely, the perception of ecological costs was low, ranging from 11% (tourists) to 15% (local dweller). Finally, the territorial dimension exhibited the greatest contrasts between costs and benefits. Territorial costs were the most prominent among all analyzed dimensions, being most intensely perceived by fishers (56%) and local dweller (46%). Though other groups, such as tourism entrepreneurs and tourists, also reported significant territorial costs.

**Figure 3. Perception of costs and benefits by their respective categorical dimensions by interviewee group.**




Source: Author, 2025.

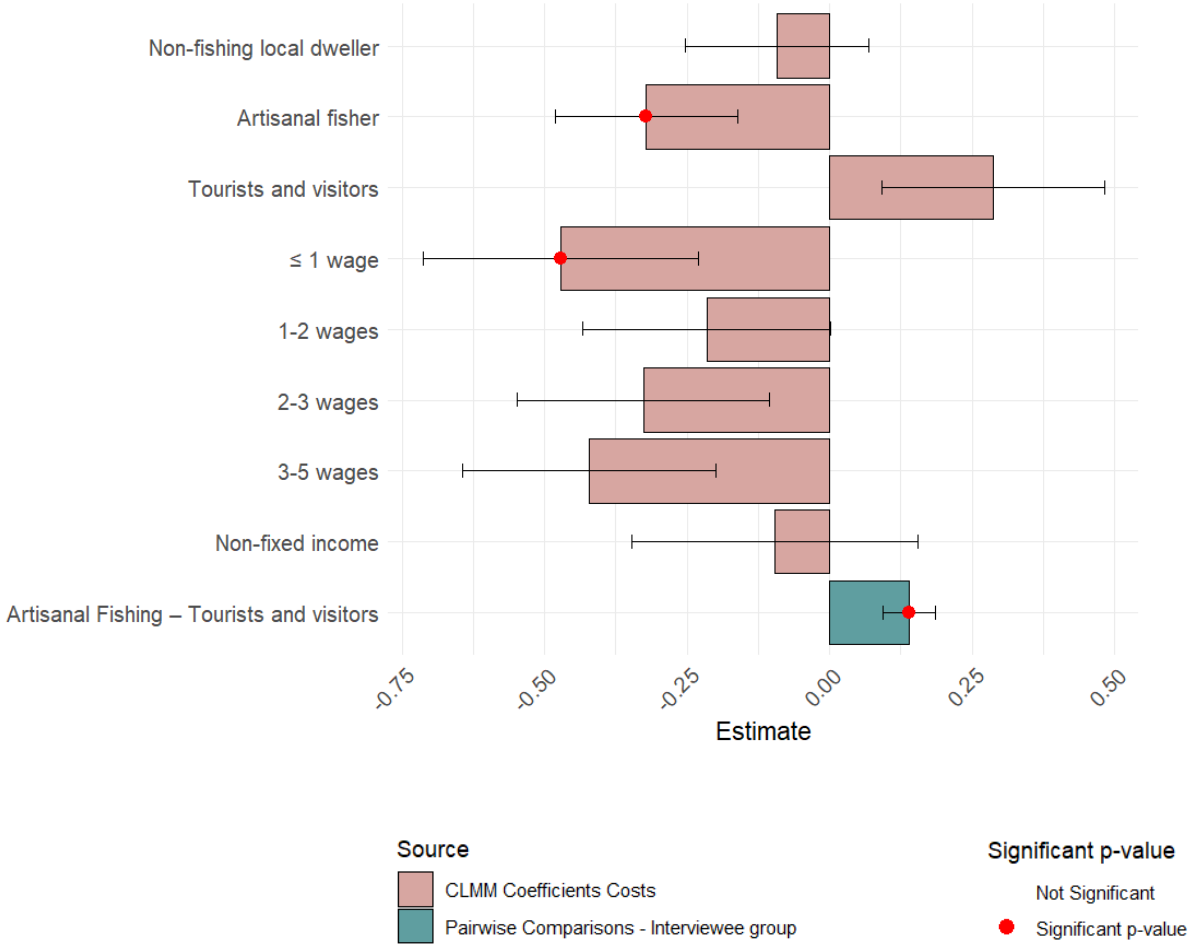
### 3.4. Socioeconomic variables on the perception of costs and benefits – CLMM

#### 3.4.1. Socioeconomic variables on cost perception

The CLMM analysis indicated that the perception of costs was influenced by the variables 'interviewee group' and 'family income' (Figure 4). The interviewees corresponding to the group of artisanal fishers showed statistical significance in the perception of costs ($p = 0.04$), as well as those with family income of one minimum wage ($p = 0.05$). Regarding the pairwise analysis,

among the significant socioeconomic variables, a significant difference was found in the perception of costs only between the category of the variable group of interviewees 'Artisanal fishing' and 'Tourists and visitors' ($\beta = 0.13$, $p = 0.01$).

**Figure 4. CLMM model coefficients and pairwise comparison: significant results of socioeconomic variables in cost perception.**




Source: Author, 2025.

Note: The CLMM model coefficients represent comparisons with following reference categories: for the **family income** variable (Non-fixed income; 3-5 wages; 2 - wages; 1-2 wages; ≤ 1 wage), the reference category is **income > 5 wages**; for the **interviewee group** variable (Tourists and visitors; Artisanal fisher; Non-fishing local dweller), the reference category is **Tourism entrepreneurs and traders**. All estimates indicate the relative effect compared to these categories. The pink bars represent the estimated CLMM coefficients for each socioeconomic variable. The blue bars represent the estimated Pairwise Comparison coefficient for the interviewee group variable. The red circles highlight the p-value ≤ 0.05. The black line illustrates the standard error range for each variable.

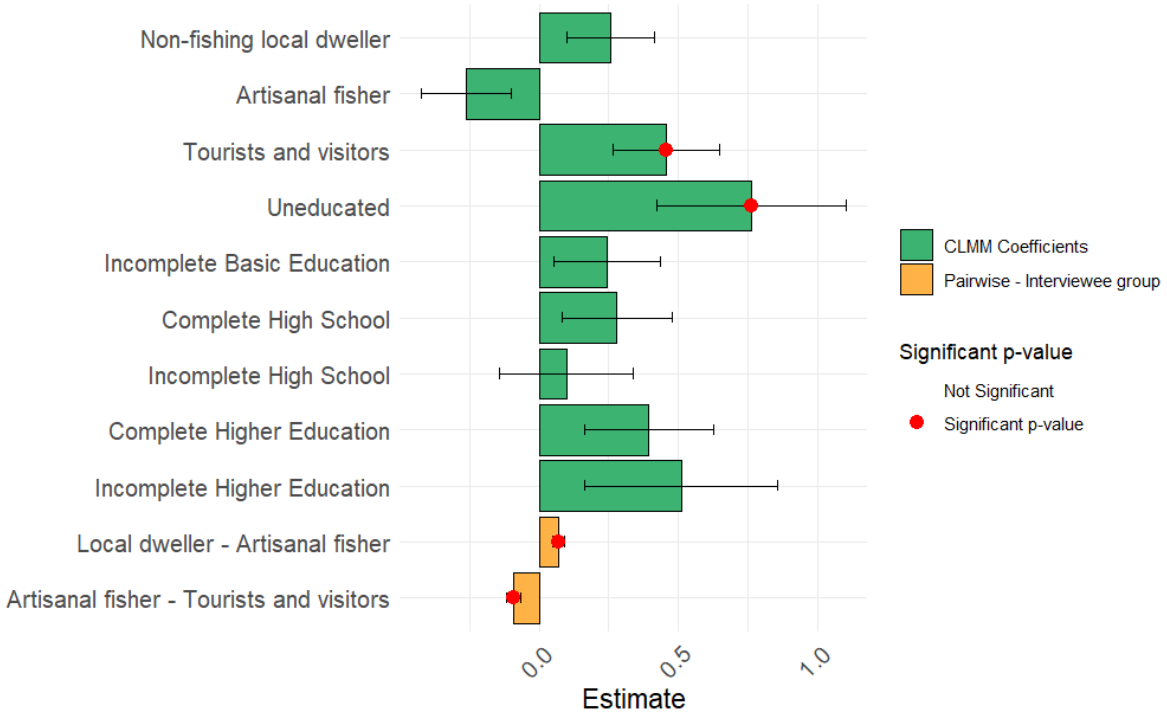
The complete table with all the results of the CLMM costs model is available in the supplementary material (APPENDIX B), and the simplified version, obtained by the stepwise procedure can be found in Appendix D. As for the results of the pairwise analysis, these are available in Appendix E.

### 3.4.2. Socioeconomic variables on benefits perception

The CLMM analysis indicated that the socioeconomic variable corresponding to tourists and visitors has statistical significance regarding the perception of the protected area benefits ($p = 0.02$) (Figure 5). However, no significance was found for local dwellers and artisanal fishers. Regarding education, the variable 'no formal education' was significant in benefit perception ($p = 0.02$). Other education categories did not show significant influence on benefit perception (Appendix C).

Pairwise analysis revealed significant differences in APACC benefit perception between local dwellers and artisanal fishers, with local dwellers perceiving fewer costs than fishers ($\beta = -0.07$, $p = 0.009$). A statistically significant difference was also found in benefit perception between artisanal fishers and tourists/visitors, with the former perceiving more costs than the latter ($\beta = 0.09$, $p = 0.002$).

**Figure 5. CLMM Model Coefficients and Pairwise Comparison: Significant Results of Socioeconomic Variables in Benefit Perception.**




Source: Author, 2025.

Note: The CLMM model coefficients represent comparisons with following reference categories: for the **education level** variable (Incomplete Higher Education; Complete Higher Education; Incomplete High School; Complete High School; Incomplete Basic Education; Uneducated), the reference category is **complete basic education**; and for the **interviewee group** variable (Tourists and visitors; Artisanal fisher; Non-fishing local dweller), the reference category is **Tourism entrepreneurs and traders**. All estimates indicate the relative effect compared to these categories. The green bars represent the estimated CLMM coefficients for each socioeconomic variable. The yellow bars represent the estimated Pairwise Comparison coefficient for the interview region variable. The red circles highlight the p-value $\leq 0.05$. The black line illustrates the standard error range for each variable.

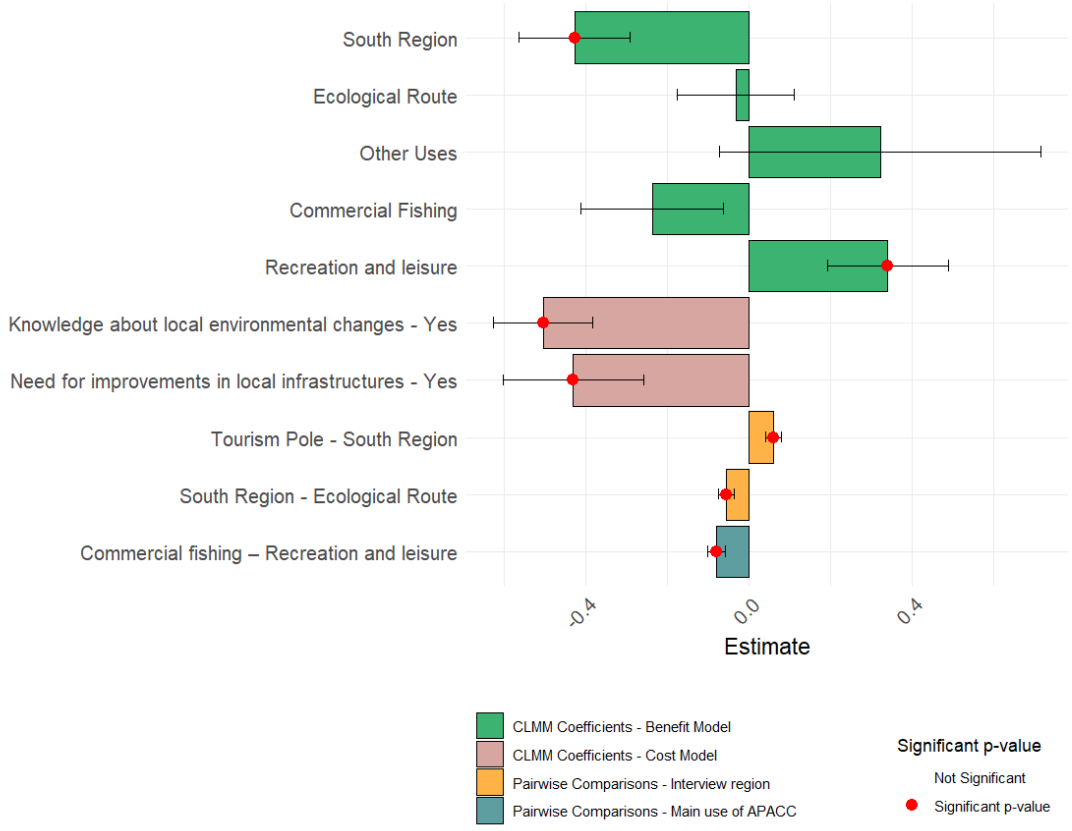
### 3.5. User experiences on the perception of costs and benefits

The CLMM analysis revealed that two user experience variables were significantly associated with the perception of APACC costs (Figure 6). Knowledge of local environmental changes had a coefficient of $\beta = -0.50$ ($p = 0.00003$), indicating that a greater understanding of local environmental changes was related to a reduced perception of costs compared to those unaware of these changes (Appendix G). Additionally, recognizing the need for local infrastructure

improvements was also a significant variable in cost perception, with costs being less perceived by those who recognized this need ($\beta = -0.43$, $p = 0.01$).

Regarding user experience variables and their association with APACC benefit perception, the results indicate a significant influence of the interview region variable and different area uses on benefit perception (Figure 6). The user experience variable 'South Region' showed statistical significance in the perception of the protected area benefits ($p = 0.002$). Moreover, the primary use of APACC related to visitation, recreation, and leisure was also significant for benefit perception ($p = 0.02$). Finally, the multiple comparison analysis (Appendix H) revealed that respondents from the Tourism Pole recognized fewer costs than those from the South Region ($\beta = -0.06$, $p = 0.005$). In contrast, respondents from the South Region perceived more costs than those from the Ecological Route ($\beta = 0.06$, $p = 0.01$). Additionally, differences in perceptions were observed between individuals who use the protected area from commercial fishing and those who use it for recreation and leisure, with the former group perceiving more costs ($\beta = 0.08$, $p = 0.001$).

**Figure 6. Coefficients of CLMM Models for Costs and Benefits, and Pairwise Comparisons: significant results of user experiences variables.**




Source: Author, 2025.

Note: The CLMM model coefficients represent comparisons with following reference categories: for the **interview region** variable (South Region; Ecological Route), the reference category is **Tourism Polo**; for the **main use of APACC** variable (Commercial Fishing; Recreation and leisure; Other Uses), the reference category is **economic activities of tourism;** for the **Knowledge about local environmental changes (Yes)** variable, the reference category is **No**; and for the **Need for improvements in local infrastructures (Yes)** variable, the reference category is **No**. All estimates indicate the relative effect compared to these categories. The green bars represent the estimated CLMM Model Coefficients Benefits for each User Experience Variable. The pink bars represent the estimated CLMM Model Coefficients Costs for each User Experience Variable. The yellow bars represent the estimated Pairwise Comparison coefficient for the interview region variable and the blue bars for the main use of APACC variable. The red circles highlight the p-value $\leq 0.05$. The black line illustrates the standard error range for each variable.

## 4. DISCUSSION

The results of this study provide important insights into user perceptions of the costs and benefits of protected areas. Regarding the first hypothesis, which suggests that users in more vulnerable socioeconomic situations tend to perceive costs more than benefits, our results support this premise. The perception of costs was influenced by the respondents' family income, with a greater impact among those families that earn up to a minimum wage. In addition, interviewees belonging to the artisanal fisher group perceived higher costs than the other groups.

Among fishers, in particular, the APACC has been associated with higher economic and territorial costs, such as the loss of access to fishing zone and increased conflicts with the tourism sector, a scenario already reported in other studies (SIMS, 2010; MACKENZIE, 2012; GUARDA & VILA, 2020; RODRÍGUEZ-RODRÍGUEZ & LÓPEZ, 2020). However, the fact that fishers do not perceive many benefits of the MPA raises important questions. If environmental protection in MPAs should favor the recovery of biomass and, consequently, fishing activity (DI LORENZO et al., 2016), why does this perception not occur? Could the design of the APACC be failing to generate effective recovery? Are there gaps in management communication with traditional communities?

The second hypothesis, which proposed that users using the area for recreational purposes would show a more favorable perception focused on benefits, was also confirmed. Our results also showed the individuals more involved in the tourism sector, such as tourists and visitors, perceived significantly more benefits associated with MPA, and perceived more benefits than artisanal fishers. Furthermore, respondents not involved in fishing, such as non-fishing local dwellers and tourists and visitors, perceived more ecological and sociocultural benefits, such as the appreciation of nature and the preservation of landscapes. These groups, who do not directly depend on natural resources for subsistence, possible associate environmental protection with the maintenance of recreational and tourism activities, which aligns with the literature (DIAZ-CHRISTIANSEN et al., 2016; BLANCO-SALAS et al., 2019; MALLETTE et al., 2021; CAPARRÓS-MARTÍNEZ et al., 2022).

The interview region also emerged as a significant variable in analyzing perceptions of the costs and benefits associated with the protected area. In areas with greater tourism intensity, such as the Tourism Pole and the Ecological Route (DE OLIVEIRA JÚNIOR et al., 2021), the benefits

of the protected area were more pronounced than in the South Region, which is mainly characterized by a strong presence of artisanal fishing and few tourist activities. This result may have been influenced by employment opportunities, recreation and leisure attractions and infrastructure more focused on sea and beach tourism present in the Tourism Polo and Ecological Route. The Ecological Route region has a beach certified with a Blue Flag, which reinforces the positive perception of environmental conservation and its economic impacts. Additionally, community and environmental education initiatives, such as the Peixe-Boi (Manatee) Association, highlight the role of local partnerships in promoting conservation (HUNT et al., 2015; ARDOIN et al., 2020; DE OLIVEIRA JÚNIOR et al., 2024).

The perception of environmental changes in the region also proved to be a relevant aspect. In general, interviewees who noticed changes in the environment tended to recognize fewer costs associated with the protected area. However, it is important to consider that this perception may vary according to the experience of each group (FERNANDES et al., 2004). While residents and fisherman have observed the changes over decades, tourists and visitors have a more specific contact with the region, which may influence the way they evaluate the effects of conservation. This may lead them to see conservation as a necessary benefit, reducing the perception of costs. On the other hand, the lack of perception of environmental changes may make it difficult to recognize negative impacts and compromise community participation in conservation management (DU et al., 2018; WAEBER et al., 2018; LO et al., 2022).

Interestingly, costs perceptions were also shaped by how individuals viewed local infrastructure. Those who identified a need for local for improvements in recreational and leisure infrastructure perceived higher costs associated with the MPA than those who did not perceive such improvements needs. This seemingly counterintuitive result suggests may have been influenced by other factors that were not measured by the study, such as expectations about future investment in the region. In contrast, individuals who did not perceive such infrastructure deficits had stronger cost perceptions.

Another important point was the relationship between low recognition of the benefits of territorial management and conflicts between fishers and tourism entrepreneurs. While tourism brings economic benefits, it also exerts pressure on natural resources and replaces artisanal fishing with more profitable tourism activities, affecting fishing culture and traditional knowledge (LÓPEZ-MARTÍNEZ & ESPESO-MOLINERO, 2020; MANGUNJAYA et al., 2021; SILVEIRA

& FERREIRA, 2024). This suggest that, despite conservation efforts, there are still challenges in mediating conflicts and addressing the needs of local communities. The socioeconomic analysis reinforces these trends. Fishers interviewed tended to be older and have lower levels of education, while tourism entrepreneurs and tourists were predominantly younger and more educated. This dynamic of age inversion observed illustrates the phenomenon known as the "*Graying of the fleet"*, which describes the migration of younger generations into the tourism sector in response to the economic challenges of artisanal fishing (DONKERSLOOT & CAROTHERS, 2016; CRAMER et al., 2018).

Regarding education, although other studies indicate that individuals with higher educational levels tend to recognize more benefits from PAs (OLDEKOP et al., 2016; WARD et al., 2018; SHAHI et al., 2023; THAPA & DIEDRICH, 2023), our results suggest a more complex scenario. Education may not only influence environmental perception but also reflect structural inequalities in access to resources and opportunities (LIU et al., 2010; SENA-VITTINI et al., 2023, DE OLIVEIRA JÚNIOR et al., 2024). Individuals with lower income reported more costs, while those with higher income perceived more benefits, reflection greater access to recreational and tourism opportunities. Thus, perceptions of protected areas are shaped by both environmental knowledge and broader socioeconomic factors (ALLENDORF et al., 2006; TUAN, 2012; BELKAYALI et al., 2016; MARTÍNEZ & MANZANO-GARCÍA, 2016; MALLETTE et al., 2021).

## 5. CONCLUSIONS

For a more balanced distribution of costs and benefits associated with Category V PAs, it is crucial that these areas implement more inclusive governance strategies sensitive to social dynamics. Additionally, the recognition of tourism and leisure activities in local economic development should be incorporated into governance strategies for MPAs. Our study showed that individuals whose experiences in the APACC are related to tourism and leisure tend to perceive more conservation benefits. This finding backs up the idea that management policies that promote sustainable tourism and inclusive leisure can strengthen socio and economic support for Category V PAs, benefiting both users and conservation efforts. Furthermore, the formulation of management plans should integrate social, economic, and ecological dimensions to ensure the

sustainability of protected areas. Sustainable tourism and the promotion of artisanal fishing should be prioritized as development sources in MPAs, provided they are accompanied by strategies to mitigate conflicts between these sectors, ensuring social cohesion and management effectiveness. Future research should deepen the analysis of the impacts of Category V PAs on the groups that perceive the most costs, particularly socioeconomically vulnerable traditional communities. This will enable the development of more effective solutions to reduce inequalities and strengthen social inclusion in the management of Category V PAs.

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## SUPPLEMENTARY MATERIAL

## APPENDIX A - Questionnaire

### Socioeconomic characterization

1. Interviewee Name:

2. Age:

3. What is your gender?
( ) Female
( ) Male
( ) Would prefer not to answer
Other:

4. What is your level of education?
1. ( ) No formal education
2. ( ) Incomplete elementary school
3. ( ) Complete elementary school
4. ( ) Incomplete high school
5. ( ) Complete high school
6. ( ) Incomplete higher education
7. ( ) Complete higher education
8. ( ) Incomplete postgraduate degree
9. ( ) Complete postgraduate degree

5. What is your religion/belief?
1. ( ) Catholic
2. ( ) Evangelical
3. ( ) Spiritism
4. ( ) Candomblé
5. ( ) Umbanda
6. ( ) Jehovah's Witnesses
7. ( ) Indigenous/traditional religions
8. ( ) No religion
9. ( ) I would prefer not to answer
10. Other:

6. What do you think of the economic situation in your region?
( )terrible ( )bad ( )fair ( )good ( )excellent

7. What do you think of your economic (or financial, or income) situation?
( )terrible ( )bad ( )fair ( )good ( )excellent

8. Where do you live (state/city/neighborhood, town)?

9. How long have you lived in your place of residence?

If you are in the region only for tourism, how long have you been visiting the region?

10. How many people live in your home?

11. Do you have access to the following services:
( ) Basic sanitation
( ) Electricity
( ) Health

12. Do you receive any type of government assistance?
( ) No
( ) Bolsa Família
( ) Unemployment insurance
( ) Fishing/closed season insurance
( ) Other social assistance programs, which ones?

13. What is your main occupation (profession/job)?

[If you answered “fisherman” in the previous question] Do you come from a family of fishermen?
( ) Yes ( ) No

14. What are the main sources of income for the people who live with you in your house?

15. How much is your monthly income?

16. What is the monthly family income (including the income of the people who live in the same house)?

**User experiences**

1. In your opinion, what is most important for the region (e.g. sea and beach)?
( ) Nature protection (e.g. marine animals, corals, etc.) ( ) Tourism (related answers)
( ) Fishing (related answers) ( ) Other, which one?

2. Would you be able to inform me if this region of sea and beach receives any type of environmental protection? ( ) No ( ) Yes, which one?

3. Are you aware of any rules or regulations established for environmental protection in the region?
( ) No ( ) Yes, which one?

4. What purpose do you use the sea and beach in the region for?
( ) visiting, recreation, leisure, contemplation of nature
( ) commercial fishing
( ) economic activities focused on tourism
( ) Other, which one?

5. What are the places in the region that you most like to go to or would like to visit?
.
6. What are the things that interest you most about the sea and beaches in this region?
.
7. Have you noticed any changes in the sea, beaches and landscape of this region over the years?
( ) No ( ) Yes, which ones?
[If you answered "yes" to the previous question] In your opinion, what caused/provoked these changes?

8. Have you ever participated in classes (lectures, courses) or things that teach about the sea or nature in the region? (This can also be teaching about local nature through tourist guides in the region)
( ) No ( ) Yes, which ones?

9. Have you ever used any infrastructure in the region specifically for tourism and leisure in nature? (for example: viewpoints, visitor centers, trails) ( ) No ( ) Yes, which ones?

10. Do you think there needs to be more infrastructure in the region's sea and beach areas for residents and tourists? (e.g. bathrooms, squares, fishing market, information signs, trails, etc.) ( ) No ( ) Yes, which ones?

11. Have you ever had any problems with other people in the region? (e.g. tourists, merchants, businesspeople, fishermen or non-fishermen residents, employees of the AP or environmental agencies)?
( ) No ( ) Yes, which ones?

12. Have you ever experienced any problems or unpleasant situations when using the sea or beach (nature) to do something? (such as fishing, leisure, sports, tourism) ( ) No ( ) Yes, which ones?

13. Have you ever experienced anything good when using the sea or beach in the region to do something? (e.g.: seeing a beautiful animal or one that is not common in the region; making friends; having an unforgettable experience) ( ) No ( ) Yes, which one?

14. What is your opinion on the importance of protecting the nature of this region for the local population?
.
15. What is your opinion on the importance of protecting the nature of this region for local tourism?

## Costs and benefits of environmental conservation in the Protected Area

Regarding the following statements, answer: (5) I completely agree; (4) I agree; (3) I neither agree nor disagree; (2) I disagree; (1) I completely disagree.

| Statements | Notes |
|---|---|
| **Economic costs and benefits** | ------- |
| Environmental protection in this region causes harm to fishing communities and local residents | |
| Environmental protection helps generate income for fishing communities and local residents | |
| Environmental protection in the area does not help generate formal jobs (with a formal contract) for local residents | |
| Environmental protection helps the region grow economically | |
| The existence of environmental protection in the region increases the local cost of living | |
| **Sociocultural costs and benefits** | ------- |
| Environmental protection in the region helps the local community maintain its lifestyle | |
| Environmental protection in the region attracts tourists and negatively affects the lifestyle of local residents | |
| Environmental protection in the region helps to enhance the culture and traditions of the local community | |
| Environmental protection in the region does not meet the needs of the local community, but rather of businesspeople and tourists | |
| Environmental protection in the region helps people appreciate nature and feel good | |
| **Ecological costs and benefits** | ------- |
| Environmental protection is necessary to preserve nature in the region | |
| Tourism in the region causes damage to nature | |
| Environmental protection helps preserve the region's landscapes | |
| Environmental protection does not help reduce waste and local pollution | |
| Environmental protection in the region strengthens environmental education and the importance of nature | |
| **Territorial management costs and benefits** | ------- |
| Environmental protection makes access to the sea and other places in the region more difficult | |
| Environmental protection in the region is good for nature and for all people in the region equally | |
| The region does not have spaces, places and specific infrastructures for fun, recreation and comfort in nature | |
| If there were no environmental protection the region would not be very different, there would not be many problems for nature and the local community | |
| The rules and restrictions imposed for environmental protection in the region increase the chances of conflicts occurring in the area | |

## APPENDIX B – CLMM Model Results: socioeconomic variables in the costs perception

| Variable | Category | Reference category | Estimate (β) | Std. Error | Z value | P-value |
|---|---|---|---|---|---|---|
| **Interviewee group** | Local dweller | Tourism entrepreneurs and traders | -0.0788214 | 0.1670087 | -0.472 | 0.6370 |
| | Artisanal fisher | | -0.3985053 | 0.1882758 | -2.117 | **0.0343** |
| | Tourists and visitors | | 0.3307262 | 0.2088440 | 1.584 | 0.1133 |
| **Sex** | Female | Male | -0.1270354 | 0.1370596 | -0.927 | 0.3540 |
| **Education Level** | Uneducated | Complete basic education | 0.3551080 | 0.3369046 | 1.054 | 0.2919 |
| | Incomplete Basic Education | | -0.0417289 | 0.2120202 | -0.197 | 0.8440 |
| | Complete High School | | -0.4040637 | 0.2202526 | -1.835 | 0.0666 |
| | Incomplete High School | | 0.0540641 | 0.2665601 | 0.203 | 0.8393 |
| | Complete Higher Education | | -0.1423354 | 0.2589872 | -0.550 | 0.5826 |
| | Incomplete Higher Education | | -0.2297555 | 0.3384425 | -0.679 | 0.4972 |
| **Age** | 31 – 40 | 18 – 30 | -0.0014457 | 0.1871060 | -0.008 | 0.9938 |
| | 41 – 50 | | -0.3376285 | 0.1878559 | -1.797 | 0.0723 |
| | 51 – 60 | | -0.3289851 | 0.1854534 | -1.774 | 0.0761 |
| | > 61 | | -0.3168016 | 0.2059938 | -1.538 | 0.1241 |
| **Family income** | Non-fixed income | > 5 wages | -0.0642971 | 0.2678826 | -0.240 | 0.8103 |
| | ≤ 1 wage | | -0.5158892 | 0.2641049 | -1.953 | 0.0508 |
| | 1 - 2 wages | | -0.1748085 | 0.2441510 | -0.716 | 0.4740 |
| | 2 - 3 wages | | -0.2882461 | 0.2347452 | -1.228 | 0.2195 |
| | 3 - 5 wages | | -0.3246872 | 0.2367194 | -1.372 | 0.1702 |
| **Personal economic situation** | Terrible | Good | -0.2728406 | 0.7221700 | -0.378 | 0.7056 |
| | Bad | | -0.0379520 | 0.2189073 | -0.173 | 0.8624 |
| | Average | | -0.0257425 | 0.1299864 | -0.198 | 0.8430 |
| | Excellent | | -0.2950238 | 0.3010218 | -0.980 | 0.3270 |
| **Local economic situation** | Terrible | Good | -0.0735165 | 0.2709612 | -0.271 | 0.7861 |
| | Bad | | -0.2226359 | 0.1949905 | -1.142 | 0.2535 |
| | Average | | -0.0006838 | 0.1353814 | -0.005 | 0.9960 |
| | Excellent | | 0.3215930 | 0.3035424 | 1.059 | 0.2894 |

## APPENDIX C – CLMM Model Results: socioeconomic variables in the benefits perception

| Variable | Category | Reference category | Estimate (β) | Std. Error | Z value | P-value |
|---|---|---|---|---|---|---|
| **Interviewee group** | Local dweller | Tourism entrepreneurs and traders | 0.27017 | 0.16762 | 1.612 | 0.1070 |
| | Artisanal fisher | | -0.20246 | 0.17791 | -1.138 | 0.2551 |
| | Tourists and visitors | | 0.45517 | 0.21422 | 2.125 | **0.0336** |
| **Gender** | Female | Male | 0.01894 | 0.13839 | 0.137 | 0.8911 |
| **Education Level** | Uneducated | Complete basic education | 0.72014 | 0.34552 | 2.084 | **0.0371** |
| | Incomplete Basic Education | | 0.23058 | 0.19439 | 1.186 | 0.2356 |
| | Complete High School | | 0.23852 | 0.20910 | 1.141 | 0.2540 |
| | Incomplete High School | | 0.12777 | 0.24466 | 0.522 | 0.6015 |
| | Complete Higher Education | | 0.42389 | 0.25477 | 1.664 | 0.0961 |
| | Incomplete Higher Education | | 0.51231 | 0.35683 | 1.436 | 0.1511 |
| **Age** | 31 – 40 | 18 – 30 | -0.19443 | 0.18325 | -1.061 | 0.2887 |
| | 41 – 50 | | -0.08092 | 0.18827 | -0.430 | 0.6673 |
| | 51 – 60 | | -0.13113 | 0.18346 | -0.715 | 0.4748 |
| | > 61 | | -0.13510 | 0.20424 | -0.661 | 0.5083 |
| **Family income** | Non-fixed income | > 5 wages | 0.05072 | 0.26309 | 0.193 | 0.8471 |
| | ≤ 1 wage | | 0.27416 | 0.26983 | 1.016 | 0.3096 |
| | 1 - 2 wages | | -0.00586 | 0.24448 | -0.024 | 0.9809 |
| | 2 - 3 wages | | 0.03286 | 0.23787 | 0.138 | 0.8901 |
| | 3 - 5 wages | | 0.27577 | 0.25019 | 1.102 | 0.2704 |
| **Personal economic situation** | Terrible | Good | -1.02182 | 0.76484 | -1.336 | 0.1816 |
| | Bad | | 0.11352 | 0.20938 | 0.542 | 0.5877 |
| | Average | | 0.13554 | 0.12914 | 1.050 | 0.2939 |
| | Excellent | | 0.25268 | 0.29897 | 0.845 | 0.3980 |
| **Local economic situation** | Terrible | Good | -0.32479 | 0.25563 | -1.271 | 0.2039 |
| | Bad | | -0.17446 | 0.19098 | -0.914 | 0.3610 |
| | Average | | -0.12424 | 0.13463 | -0.923 | 0.3561 |
| | Excellent | | 0.19668 | 0.31984 | 0.615 | 0.5386 |

## APPENDIX D – Simplified CLMM Model Results (Stepwise): Significant socioeconomic variables in costs and benefits perception

| Variable | Category | Reference category | Estimate (β) | Std. Error | Z value | P-value |
|---|---|---|---|---|---|---|
| **COSTS** | | | | | | |
| Interviewee group | Local dweller | Tourism entrepreneurs and traders | -0.09292 | 0.16054 | -0.579 | 0.5627 |
| | Artisanal fisher | | -0.32148 | 0.15986 | -2.011 | **0.0443** |
| | Tourists and visitors | | 0.28622 | 0.19538 | 1.465 | 0.1429 |
| Family income | Non-fixed income | > 5 wages | -0.09655 | 0.25088 | -0.385 | 0.7003 |
| | ≤ 1 wage | | -0.47224 | 0.24125 | -1.958 | **0.0503** |
| | 1 - 2 wages | | -0.21580 | 0.21740 | -0.993 | 0.3209 |
| | 2 - 3 wages | | -0.32632 | 0.22125 | -1.475 | 0.1402 |
| | 3 - 5 wages | | -0.42171 | 0.22288 | -1.892 | 0.0585 |
| **BENEFITS** | | | | | | |
| Interviewee group | Local dweller | Tourism entrepreneurs and traders | 0.2558 | 0.1583 | 1.616 | 0.1061 |
| | Artisanal fisher | | -0.2615 | 0.1618 | -1.616 | 0.1060 |
| | Tourists and visitors | | 0.4571 | 0.1924 | 2.376 | **0.0175** |
| Education Level | Uneducated | Complete basic education | 0.7635 | 0.3402 | 2.244 | **0.0248** |
| | Incomplete Basic Education | | 0.2444 | 0.1908 | 1.281 | 0.2003 |
| | Complete High School | | 0.2789 | 0.1990 | 1.402 | 0.1610 |
| | Incomplete High School | | 0.0977 | 0.2400 | 0.407 | 0.6840 |
| | Complete Higher Education | | 0.3939 | 0.2328 | 1.685 | 0.0920 |
| | Incomplete Higher Education | | 0.5104 | 0.3477 | 1.468 | 0.1421 |

**APPENDIX E – Pairwise comparisons of significant socioeconomic predictors in cost and benefit perceptions.**

| **COSTS** | | | | |
|---|---|---|---|---|
| **Variable** | **Pairwise Comparison** | **Difference Cost** | **Difference Benefit** | **p-value** |
| **Interviewee group** | Tourism entrepreneurs – Local dweller | -0.0216 | 0.0216 | 0.9385 |
| | Tourism entrepreneurs – Artisanal Fishing | -0.0765 | 0.0765 | 0.1823 |
| | Tourism entrepreneurs – Tourists and visitors | 0.0629 | -0.0629 | 0.4495 |
| | Local dweller – Artisanal Fishing | -0.0549 | 0.0549 | 0.4860 |
| | Local dweller – Tourists and visitors | 0.0845 | -0.0845 | 0.2082 |
| | Artisanal Fishing – Tourists and visitors | 0.1395 | -0.1395 | **0.0137** |
| **Family income** | > 5 wages – ≤ 1 wage | -0.1081 | 0.1081 | 0.3665 |
| | > 5 wages – 1 - 2 wages | -0.0477 | 0.0477 | 0.9177 |
| | > 5 wages – 2 - 3 wages | -0.0733 | 0.0733 | 0.6730 |
| | > 5 wages – 3 - 5 wages | -0.0960 | 0.0960 | 0.4068 |
| | > 5 wages – Non-fixed income | -0.0210 | 0.0210 | 0.9989 |
| | ≤ 1 wage – 1 - 2 wages | 0.0604 | -0.0604 | 0.7544 |
| | ≤ 1 wage – 2 - 3 wages | 0.0348 | -0.0348 | 0.9800 |
| | ≤ 1 wage – 3 - 5 wages | 0.0121 | -0.0121 | 0.9999 |
| | ≤ 1 wage - Non-fixed income | 0.0872 | -0.0872 | 0.5628 |
| | 1 - 2 wages – 2 - 3 wages | -0.0256 | 0.0256 | 0.9879 |
| | 1 - 2 wages – 3 - 5 wages | -0.0482 | 0.0482 | 0.9282 |
| | 1 - 2 wages – Non-fixed income | 0.0268 | -0.0268 | 0.9910 |
| | 2 - 3 wages – 3 - 5 wages | -0.0226 | 0.0226 | 0.9980 |
| | 2 - 3 wages - Non-fixed income | 0.0524 | -0.0524 | 0.8911 |
| | 3 – 5 wages - Non-fixed income | 0.0750 | -0.0750 | 0.7713 |
| **BENEFITS** | | | | |
| **Interviewee group** | Tourism entrepreneurs – Local dweller | 0.0316 | -0.0316 | 0.3732 |
| | Tourism entrepreneurs – Artisanal Fishing | -0.0384 | 0.0384 | 0.3736 |
| | Tourism entrepreneurs – Tourists and visitors | 0.0527 | -0.0527 | 0.0688 |
| | Local dweller – Artisanal Fishing | -0.0700 | 0.0700 | **0.0089** |
| | Local dweller – Tourists and visitors | 0.0211 | -0.0211 | 0.7275 |
| | Artisanal Fishing – Tourists and visitors | 0.0911 | -0.0911 | **0.0019** |
| **Education Level** | Complete basic education – Incomplete basic education | 0.03501 | -0.03501 | 0.8775 |
| | Complete basic education – Complete high school | 0.03952 | -0.03952 | 0.8264 |
| | Complete basic education – Incomplete high school | 0.01465 | -0.01465 | 0.9996 |
| | Complete basic education – Uneducated | 0.09241 | -0.09241 | 0.1477 |
| | Complete basic education – Complete higher education | 0.05380 | -0.05380 | 0.6417 |
| | Complete basic education – Incomplete higher education | 0.06713 | -0.06713 | 0.6885 |
| | Incomplete basic education – Complete high school | 0.00451 | -0.00451 | 1.0000 |
| | Incomplete basic education – Incomplete high school | -0.02036 | 0.02036 | 0.9933 |
| | Incomplete basic education – Uneducated | 0.05740 | -0.05740 | 0.5000 |
| | Incomplete basic education – Complete higher education | 0.01880 | -0.01880 | 0.9916 |
| | Incomplete basic education – Incomplete higher education | 0.03213 | -0.03213 | 0.9784 |
| | Complete high school – Incomplete high school | -0.02487 | 0.02487 | 0.9796 |
| | Complete high school – Uneducated | 0.05289 | -0.05289 | 0.6295 |
| | Complete high school – Complete higher education | 0.01428 | -0.01428 | 0.9971 |
| | Complete high school – Incomplete higher education | 0.02761 | -0.02761 | 0.9880 |
| | Incomplete high school – Uneducated | 0.07776 | -0.07776 | 0.3767 |
| | Incomplete high school – Complete higher education | 0.03915 | -0.03915 | 0.9087 |
| | Incomplete high school – Incomplete higher education | 0.05248 | -0.05248 | 0.8818 |
| | Uneducated – Complete higher education | -0.03861 | 0.03861 | 0.9256 |

| | | | | |
|---|---|---|---|---|
| | Uneducated – Incomplete higher education | -0.02528 | 0.02528 | 0.9975 |
| | Complete higher education – Incomplete higher education | 0.01333 | -0.01333 | 0.9998 |

## APPENDIX F – CLMM Model Results: User experience variables in costs and benefits perception

| Variable | Category | Reference category | Estimate (β) | Std. Error | Z value | P-value |
|---|---|---|---|---|---|---|
| **COSTS** | | | | | | |
| Interview region | South Region | Tourism Pole | 0.08324 | 0.14111 | 0.590 | 0.555236 |
| | Ecological Toute | | -0.02809 | 0.14118 | -0.199 | 0.842309 |
| Knowledge about local environmental protection | Yes | No | 0.21241 | 0.13285 | 1.599 | 0.109836 |
| Main use of APACC | Others activities | Economic activities of tourism sector | -0.70931 | 0.38045 | -1.864 | 0.062268 |
| | Commercial fishing | | -0.36149 | 0.18771 | -1.926 | 0.054130 |
| | Recreation and leisure | | -0.11038 | 0.16057 | -0.687 | 0.491806 |
| Knowledge about local environmental changes | Yes | No | -0.48905 | 0.13201 | -3.705 | **0.000212** |
| Participation in classes and/or courses on local ecological knowledge | Yes | No | -0.15787 | 0.12818 | 1.232 | 0.218107 |
| Use of infrastructures intended for leisure and recreation | Yes | No | -0.01546 | 0.12165 | -0.127 | 0.898891 |
| Need for improvements in local infrastructures | Yes | No | -0.44159 | 0.17315 | -2.550 | **0.010762** |
| Conflicts with other APACC users | Yes | No | -0.22860 | 0.16455 | -1.389 | 0.164767 |
| Experienced any unpleasant situations when using local nature | Yes | No | -0.07671 | 0.14322 | -0.536 | 0.592209 |
| Experienced something good and pleasant when using local nature | Yes | No | 0.22191 | 0.14926 | 1.487 | 0.137076 |
| **BENEFITS** | | | | | | |
| Interview region | South Region | Tourism Pole | -0.37443 | 0.13787 | -2.716 | 0.00661 |
| | Ecological Route | | -0.03200 | 0.14472 | -0.221 | 0.82501 |
| Knowledge about local environmental protection | Yes | No | -0.05884 | 0.13164 | -0.447 | 0.65489 |
| Main use of APACC | Other uses | Economic activities of tourism sector | 0.30545 | 0.39254 | 0.778 | 0.43649 |
| | Commercial fishing | | -0.19193 | 0.17676 | -1.086 | 0.27754 |
| | Recreation and leisure | | 0.26185 | 0.15640 | 1.674 | 0.09409 |
| Knowledge about local environmental changes | Yes | No | -0.19925 | 0.13282 | -1.500 | **0.13357** |
| Participation in classes and/or courses on local ecological knowledge | Yes | No | -0.06581 | 0.12595 | -0.522 | 0.60135 |
| Use of infrastructures intended for leisure and recreation | Yes | No | 0.12045 | 0.12124 | 0.993 | 0.32047 |
| Need for improvements in local infrastructures | Yes | No | -0.16925 | 0.17620 | -0.961 | 0.33675 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Conflicts with other APACC users | Yes | No | 0.01411 | 0.16131 | 0.087 | 0.93030 |
| Experienced any unpleasant situations when using local nature | Yes | No | -0.04396 | 0.13928 | -0.316 | 0.75227 |
| Experienced something good and pleasant when using local nature | Yes | No | 0.10453 | 0.14673 | 0.712 | 0.47621 |

## APPENDIX G – Simplified CLMM Model Results (Stepwise): Significant user experience variables in costs and benefits perception

| Variable | Category | Reference category | Estimate (β) | Std. Error | Z value | P-value |
|---|---|---|---|---|---|---|
| **COSTS** | | | | | | |
| Knowledge about local environmental changes | Yes | No | -0.5050 | 0.1215 | -4.155 | **3.25e-05** |
| Need for improvements in local infrastructures | Yes | No | -0.4312 | 0.1716 | -2.513 | **0.012** |
| **BENEFITS** | | | | | | |
| Interview region | South Region | Tourism Pole | -0.42813 | 0.13549 | -3.160 | **0.00158** |
| | Ecological Route | | -0.03278 | 0.14292 | -0.229 | 0.81857 |
| Main use of APACC | Other uses | Economic activities of tourism sector | 0.32126 | 0.39338 | 0.817 | 0.41411 |
| | Commercial fishing | | -0.23715 | 0.17440 | -1.360 | 0.17389 |
| | Recreation and leisure | | 0.33901 | 0.14833 | 2.286 | **0.02228** |

## APPENDIX H – Pairwise comparisons of significant user experience predictors in cost and benefit perceptions.

| Variable | Pairwise Comparison | Difference Cost | Difference Benefit | p-value |
|---|---|---|---|---|
| **Interview region** | Tourism Pole – South Region | -0.06024 | 0.06024 | **0.0046** |
| | Tourism Pole – Ecological Route | -0.00403 | 0.00403 | 0.9713 |
| | South Region – Ecological Route | 0.05621 | -0.05621 | **0.0115** |
| **Main use of APACC** | Economic activities of tourism – Other uses | 0.04178 | -0.04178 | 0.8103 |
| | Economic activities of tourism – Commercial fishing | -0.03690 | 0.03690 | 0.5227 |
| | Economic activities of tourism – Recreation and leisure | 0.04383 | -0.04383 | 0.1379 |
| | Other uses – Commercial fishing | -0.07868 | 0.07868 | 0.3456 |
| | Other uses – Recreation and leisure | 0.00205 | -0.00205 | 1.0000 |
| | Commercial fishing – Recreation and leisure | 0.08073 | -0.08073 | **0.0010** |