Literature Review: The Status of Youth and Rural Education in Small-Scale Fishing Communities

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Abstract

The body of knowledge describing youth in agri-food systems is growing. However, there is a notable lack of evidence and studies explicitly related to the status of young people in fish-dependent communities, or the roles young learners, educators, and schools play in the realization of sustainable small-scale fisheries (SSF) and aquaculture (Arulingam *et al.*, 2019).

The primary purpose of this exploratory literature review is to address this gap. This review will inform the development of an experimental common worlds curriculum (Taylor, 2017) that utilizes FAO *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication,* or the Small-Scale Fisheries Guidelines (FAO, 2015), as a pathway for young learners from SSF communities to explore their relationships with their aquatic environments, communities, and social-ecological resources in playful, creative and actionable ways.

Initial findings suggest various challenges contribute to declining interest amongst youth to remain engaged in small-scale fisheries and aquaculture, though the dynamics are poorly understood (Fry *et al.*, 2021). Education is one of the first requirements for engagement in local food systems, which also enables community strategizing and data collection processes (Fry *et al.*, 2021). However, the literature argues that formal education in fishing villages retains a foundational metrocentrism, diminishing the exposure of young learners to ecological and traditional forms of knowledge. Students who are successful in formal education systems effectively "learn to leave" (Corbett, 2007), while those whose knowledge and interests do not "resonate" within the classroom setting tend to drop out. Research indicates that it is essential to incorporate the “power of place” within education as a means of personalized learning that utilizes authentic experiences to enable complex problem-solving, collaboration, critical thinking skills, and leads to higher retention rates (Te Kete Ipurangi, 2022).

Multifaceted challenges impact youth differently from other social groups (Fry *et al.*, 2021). Rural educators in fishing villages face barriers providing students in marginalized, vulnerable communities with quality educational opportunities. Greater understanding of the needs is required in order to develop better-targeted responses.

The SSF Guidelines Curriculum development team produced this literature review during the *International Year of Artisanal Fisheries and Aquaculture 2022* (IYAFA 2022). The With the intention of accessibility, the literature review is available here:

www.ssfguidelinescurriculum.com/literature-review.

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Acronyms

ABL	Adventure-Based Learning
AGRIS	International System for Agricultural Science and Technology
CBRM	Community-based resource management
CDWG	Curriculum Development Working Group
CMT	Customary marine tenure
CWP	Common Worlds Pedagogy
COFI	FAO Committee on Fisheries
DOP	Design-Oriented Pedagogy
EE	Environmental Education
EfS	Education for Sustainability
FAO	Food and Agriculture Organization of the United Nations
IWMI	International Water Management Institute
IYAFA 2022	International Year of Artisanal Fisheries and Aquaculture
NGO	Non-governmental organization
OCTO	Open Communications for the Ocean
PYD	Positive Youth Development
SDG	Sustainable Development Goals
SEL	Social-Emotional Learning
SIO	Scripps Institution of Oceanography
SISP	Sebastian Indian Social Project
SSF Guidelines	Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication
SSF Hub	Small-Scale Fisheries Resource and Collaboration Hub
TBTI	Too Big to Ignore
TD	Transdisciplinary
UN	United Nations
YPAR	Youth-led Participatory Action Research

Keywords

Small-scale fisheries; youth; education; aquatic resources; co-management; rural development; common worlds; environmental pedagogies; SSF Guidelines; positive youth development

1. Introduction & Methodology

1.1 Introduction

FAO *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*, or the SSF Guidelines, are the first international instrument committed completely to the small-scale fisheries sector — which is often undervalued or overlooked (FAO, 2015). Co-created and developed through a participatory process, the SSF Guidelines engaged around 4,000 SSF representatives and other stakeholders in over 120 countries in sharing their perspectives and input on the document's scope and contents.

The SSF Guidelines consider sustainable fisheries within a human-rights-based framework. Rather than address symptoms of poverty that may drive overfishing, the SSF Guidelines focus on root causes, including discrimination, marginalization, exploitation, and abuse, by focusing on systems-level social-ecological changes in policy, regulatory and institutional frameworks.

FAO is committed to supporting the implementation of the SSF Guidelines through collaboration with stakeholders, including - as listed in the SSF guidelines — governments, small-scale fishers, fish workers and their organizations, civil society organizations, research and academia, the private sector, and the donor community (FAO, 2015). Despite the active role SSF communities took in the formulation of the guidelines, there remains ample space for stakeholder participation in awareness-raising, monitoring, and evaluating the implementation of the adopted texts. As argued by Kurien in FAO special report *Involving the People: Democratizing the Implementation and Monitoring of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*,

> "A radical change is needed in order to mainstream community participation into the implementation and monitoring of guidelines. There is a need to 'take back voluntary guidelines to the community'; demystify their contents; assess from the community what indicators they will utilize to evaluate the progress of implementation; and think through with them the nature of tools to be used for this purpose. Basically, the call is for a democratization of the implementation and monitoring of voluntary guidelines making it by, for and of the community" (Kurien, 2021, p. 3).

Fisheries policy and research have historically focused on fish stocks and the marine environment with little attention paid to poverty reduction, livelihoods, social-ecological wellbeing, or the capabilities of artisanal fishing communities (Neiland and Bene, 2004). A gradual pivot towards a multi-dimensional analysis of poverty and 'livelihoods approaches' (Ellis and Freeman, 2005; Maddox, 2007) has led to more significant consideration of education and functional literacy in stakeholder co-management processes of fish stocks and other aquatic resources and approaches towards livelihoods diversification (Bene 2003,

Horemans 2004). Within this narrow focus on capacity-building through education and literacy levels, the critical roles played by young learners and local educators in formal or non-formal school settings towards development goals are overlooked.

Educational institutions and public schools embedded within SSF villages are uniquely positioned, yet untapped, implementation partners with enormous potential for raising awareness about the SSF Guidelines at the individual, household, and community levels (Adjei, 2021). Rural schools are trusted, established channels for knowledge exchange, social capital hubs, and physical spaces for discovery and dialogue. There is tremendous potential for SSF community schools to play an active role in monitoring SSF Guideline's implementation.

Rural schools have consistently played a fundamental role within their communities. In addition to providing basic education, they often serve as cultural centers for communities (Miller, 1995). They foster deep wells of social networks, traditions, and values often overlooked in nationwide curriculum designed to focus on urban learners and development. However, with the right learning tools and pedagogical approaches, rural educators can leverage their SSF as a rich, dynamic curriculum. Young learners from fish-dependent communities can simultaneously gain and contribute to a kaleidoscopic understanding of small-scale fisheries in the context of food security and poverty eradication while monitoring the SSF Guidelines implementation at a local or regional level.

Therefore, the need emerges for a comprehensive curriculum to guide teachers and students in exploration of their aquatic social-ecological system utilizing the SSF Guidelines and Positive Youth Development (PYD) as a framework. PYD is defined as “an intentional, pro-social approach that engages youth within their communities, schools, peer groups, and families in a manner that is productive and constructive.” Contrary to "deficit mindset" education reforms that view individuals, schools, and communities as broken, PYD “recognizes, utilizes, and enhances a community's strengths and promotes positive outcomes for young people by providing opportunities, fostering positive relationships, and furnishing the support needed to build on their leadership strengths” (Eshun, 2020; Youth.gov, 2023).

The overall objective of this curriculum is to increase the awareness of the SSF Guidelines among young people, local educators, and fishing families, while involving youth in monitoring the implementation of the SSF Guidelines and integrating the participatory monitoring tools presented in the upcoming FAO special report *Involving the People* (FAO, 2015). The SSF Guidelines serve as the "textbook" reference in the context of the learners' own social-ecological system, as each chapter and paragraph is supplemented with further information and data provided by subject matter experts to recognize the layered significance.

This curriculum's assignments emphasize the study of community and environment in all its complexity. Information will be generated by learners through their own initiatives including; basic needs assessments via interviews, observing and analyzing environmental and land-use patterns, documenting local history by focusing on traditional fisheries management or co-management, sense of place, natural-cultural heritage, illuminating hidden harvests, gender roles, and other key aspects of the guidelines (Miller, 1995). Students will create audio-visual narratives through their investigations.

This curriculum supports quality education in rural communities by co-creating lessons that integrate learners' social-ecological realities, values, and aspirations. This curriculum aims for higher retention rates, generational turnover, less out-migration, and to enhance the adaptive capacity of young people to address anthropogenic stressors threatening SSF sustainable futures.

The SSF Guidelines Curriculum Development Working Group sought to establish familiarity with and understanding of current research under the following four main themes and three subjects before developing the new curriculum:

1.2 Methodology

Rather than utilize a 'deficit model' that stresses what young people seemingly lack, this review examines the state of youth and education in fish-dependent communities through a positive youth development (PYD) lens. PYD approaches emphasize the positive, prosocial capacities of youth, strengthened using the resources available within young learner's communities and natural environments (ACT for Youth Center for Community Action, 2022).

In an effort to locate relevant literature across the four categories under investigation, the SSF Guidelines Curriculum Development Working Group (CDWG) uses the following resources:

- The internet using search engines such as Google and Google Scholar;
- Academic databases focusing on social and natural sciences and education;
- FAO online catalog;
- FAO International System for Agricultural Science and Technology (AGRIS)
- Individual requests made to researchers, teachers, and graduate students known to the SSF Guidelines CDWG who focus on fisheries, education, youth in agri-food systems, human rights frameworks, and participatory research approaches at FAO, Too Big to Ignore, WorldFish, Secure Fisheries, Scripps Institution of Oceanography (SIO) at the University of California San Diego, the Nicholas School of the Environment at Duke University, Stanford University, National Geographic, and the International Water Management Institute (IWMI) among others;
- Individual requests made to personal contacts of the CDWG members;

- Newsletters from FAO Technical Network on Small-Scale Fisheries, TBTI, Society for Environmental Journalism, Open Communications for the Ocean (OCTO), Women in Food and Agriculture, and SEVENSEAS Media among others;
- Sources cited as the references of reviewed literature.

In addition, the SSF Guidelines CDWG conducts interviews with select authors to gain more nuanced insights and understandings from the source's relevancy to the curriculum. The CDWG conducts interviews virtually via Google Meet, Zoom, or Whatsapp. Overall, the CDWG follows the subsequent five steps:

1. Search for relevant sources under key themes of interest.
2. Systematically review each source; reading through the literature, taking notes, highlighting keyphrases, and critically analyzing publications.
    a. For more tailored information and feedback, reach out to the authors for interviews.
3. Submit reviews through a Google Form where responses populate a Google Sheet.
    a. Questions on the Google Form ask for the title, authors, FAO citation of the source, abstract, relation to any specific SSF Guidelines chapters, and level from one to five of relevancy to the curriculum with one being "slightly relevant" to five being "absolutely must incorporate/consider." The last question asked, "why and in what ways is the source relevant to the curriculum?"
4. Review all answers and select articles' key takeaways based on relevance to curriculum.
    a. Collate the research findings, organizing them thematically according to the four categories of interest:
        i. Status of Youth in Small-Scale Fisheries and Aquaculture
            - State of Education in Fish-Dependent Communities
        ii. Environmental Pedagogies, Rural Education, and Positive Youth Development (PYD)
            - Environmental Curriculums
            - Education Initiatives in Fishing Villages for Young Learners
        iii. SSF Guidelines Implementation at the Community Level
        iv. Co-Management for Sustainable Fisheries
5. Add analyses appropriately and build on to the overall literature review's core arguments.
    a. Update website with newly reviewed sources and gained insights.

Of the eight members of the CDWG, three are dedicated to search for and review literature, interview authors or potential sources, and write analysis with support from one intern.

2. Key Takeaways from the Review of Sources

2.1 Dimensions of SSF Communities

People working in the value chain of small-scale or artisanal fishing represent the largest group of ocean and freshwater actors worldwide. However, they are overlooked and undervalued despite their significant contributions to shoreline communities' social-ecological wellbeing and resilience. They produce half of the catches destined for direct human consumption and account for approximately 90% of the employment in the sector; and nearly 50% are women (Cohen *et al.*, 2019). However, small-scale and artisanal fisheries face growing threats, mainly driven by an increasing human population and growing demand for fish products globally (d'Armengol Catà *et al.*, 2018). In addition, considering the heterogeneity of the activity and the remoteness of many SSFs, governments lack the capacities to create or apply models that manage these threats (Allison, 2001; Kolding *et al.*, 2014)

SSFs are a fundamental source of cash and calories for millions of people. Yet, they are poorly integrated into policy and scientific research despite their critical roles in preserving natural and cultural heritage and contributions to social-ecological wellbeing (FAO, 2015; Koch, 2021; Teh and Sumaila, 2013). In addition to providing food and jobs, artisanal fisheries are a source of cultural tradition, individual identity, relationality with nature, and additional nuanced contributions that have yet to be identified in the research.

There is no universal definition to sort the diversity amongst small-scale fisheries or aquaculture, making it even more challenging to precisely target these groups (FAO, 2015). FAO describes these subsectors of fisheries and aquaculture as activities that occur near the shoreline, on a small-scale with low outputs, and with limited technology and capital investment (FAO, 2005). Also, small-scale fishing and aquaculture are characterized by the use of individual or familial labor, managed by households, small groups of workers, or at the community level (Vieira, Morales, and Nunes, 2012; Teh and Sumaila, 2013). Much of their catch or production is often sold in local markets directly or through intermediaries; however, some artisanal fisheries with high levels of organization manage to reach national or international markets. In this curriculum development, terms such as small-scale and artisanal are used reciprocally in relation to these groups (Franz, 2021). It is important to note that recreational fishing, sport fishing, or angling are widely *not* categorized as "small-scale" nor "artisanal" (FAO, 2005).

In addition to the complexity among the dimensions of the activity, the wide age distribution of fishers is important when designing policies and management measures for SSFs. One of the principal characteristics of SSF people is the role of the family as a unit of both production and consumption (Vieira, Morales, and Nunes, 2012; Teh and Sumaila, 2013). Youth from fishing households play diverse, dynamic roles. Given the lack of universal definitions

for both "youth" and "small-scale fisheries," how exactly a young person is involved differs widely from wild marine fisheries in Northern Peru to cultivated fish ponds along the Mekong River, and everywhere in between. Even among fish-dependent communities in close proximity to one another, the roles of youth can vary based on intersectionalities of social categorizations and ecological diversity.

There is no universally accepted definition of "youth" (Seiders, 1995), contributing to an heterogenous interpretation among diverse cultural and political contexts (Arulingam *et al*., 2019). "Youth" is often framed as an age category for policy and bureaucratic purposes; which in turn obscures the essential dimensions of what being a youth means and entails in a society (Glover and Sumberg, 2020). For statistical purposes, FAO follows the UN definition of youth as persons between the ages of 15 and 24 years. However, at the local level, each FAO individual rural youth program decides the age ranges of their target population; many programs target youth between the ages of 8 and 20 (Seiders, 1995). For purposes of this curriculum in development, the CDWG uses the terms "youth" and "young learners' interchangeably and is interested in the status of education for students from elementary through secondary, ranging from ages five through eighteen.

Youth in the SSF sector are understood as a heterogeneous group of a non-rigid dimension of younger people, predominantly from the ages of elementary through secondary school. These youth have a direct relationship with small-scale fisheries and/or low density aquaculture. Young people with a positive view towards SSFs often have a history of being involved in fishing activities from childhood, and consider it a multiple opportunity activity (Miller, 1995; Westaway, Barratt and Seeley, 2009). Considering this, the CDWG is designing this curriculum's first iteration to engage young learners with a direct relationship with SSF communities who are completing their last two years of elementary school and their first two years of secondary school.

By and large, the areas of small-scale aquaculture and fisheries remain understudied as they pertain to youth engagement (Weeratunge, Snyder and Sze, 2010). For example, inland fisheries studies often focus on fishing sites as places of adult activity (Westaway, Barratt and Seeley, 2009), when a sizable percentage of those who frequent fishing sites are children who are either accompanying parents, working alongside them or independently.

Arulingam *et al*., (2019) offer perhaps the most robust assessment of youth's current status in artisanal fisheries considering the limited studies available. These authors note that gender roles are apparent throughout the SSF value chains as young men and women are assigned different responsibilities from an early age, which reflect the roles and responsibilities throughout the SSF value chains. From ages 15 to 30, young men and women generally occupy separate roles, with young men engaged in physical tasks associated with fish production, and young women occupied in pre- and post-harvest tasks (Weeratunge, Snyder and Sze, 2010).

Evidence suggests that participation by young people in artisanal fisheries is declining. Arulingam *et al*., (2019) noted that this trend appears especially true for youth involvement in coastal marine SSF, and less so for inland aquaculture. Factors such as uncertainty, climate variability and open access for wild-capture SSF fisheries over controllable production, access rights and yields in aquaculture should be further studied.

2.1.a Challenges

Rural youth face a different set of challenges when compared to urban youth. Challenges for rural youth include growing unemployment rates, lack of accessible education, and a shortage of social opportunities to make connections to understand their surroundings and situations.

As an example, in Costa Rica, artisanal fishing is understood as a foundational aspect of culture, as a result of the tight connection between the youth and their marine environment. However, rural education centers are generally located far from SSF communities, making them difficult for SSF youth to access on a regular basis (Cruz, Sáenz and Rivera, 2016). This educational exclusion due to rural geography and infrastructure generates social exclusion and barriers for sustainable livelihoods for youth in SSF communities in this region (Cruz, Sáenz and Rivera, 2016).

Additionally, the needs of young people tend to be generalized with those of other vulnerable groups in society, such as women and elders. This curriculum provides the opportunity to identify tools and information specifically focused on the needs of youth as an intersectional group, rather than generalizing them with other vulnerable sectors.

Rural youth confront an added array of barriers and constraints as SSF actors compete with each other for common-pool resources in coastal marine and inland environments.

Arulingam *et al*., (2019) describe the following sets of challenges for youth in SSFs and inland aquaculture:

Challenge	Description
Access to land	● Aquaculture challenges include access rights, power structures, capital, and bureaucracy, especially when navigating power structures to properly identify opportunities and rights. ● SSFs are challenged by difficulties accessing resources. This issue is commonly driven by rights-based fisheries in contexts of privatization of common-pool resources. ● Youth in rural areas are overwhelmed with participation in both agriculture and SSFs. Adding aquaculture as a 3rd alternative

	livelihood makes for a difficult equation.
Access to finance	• Rural youth face informality conditions, limiting their access to formal means of borrowing. • Financial access institutions have not yet been receptive to the unique circumstances of youth. • Informal methods are associated with exploitative interest rates and credit terms, further limiting their use as an opportunity for SSFs and aquaculture. • Youth have limited participation in cooperatives or social organizations, limiting access to those financial opportunities (i.e public funding). • Young people are not the owners of assets required for production, including boats, nets, or land required for aquaculture. These resources are often transferred intergenerationally later in life. (Fry *et al*., 2021).
Access to decision making	• SSF communities are organized within gerontocracies and hierarchies. These structures limit the ability of young representatives to express themselves and participate in influential decision making processes. • SSF organizations have limited potential to influence policy making and government decisions on regional or national scales, further challenging youth participation.
Limited knowledge and experience	• Youth have limited knowledge and acquired skills, both due to their age and to limitations in learning opportunities. Similar to the agriculture sector, formal education systems may not support livelihoods in SSF or aquaculture. • Accessing a formal education as a pathway for an alternative livelihood means that youth may lose familiarity with SSFs practices and traditional knowledge. • Young people lack inclusion in SSF decision-making processes due to their invisibility in sectoral data, fisheries management strategies, and research; further contributing to their lack of experience and limited participation (Cruz, Sáenz and Rivera, 2016).

The nature of the work, low social status, and social stigma	● Difficult working conditions are common in SSF and aquaculture in developing countries, including risk associated activities and vulnerable livelihoods. In countries such as Bangladesh, SSF households are at the margin of destitution principally associated with natural hazards and livelihood crises (Islam, 2012; Arulingam *et al*., 2019). ● Many SSFs are low-earning, and highly seasonal, making for an unstable or unsustainable income. ● These conditions contribute to a social stigma for SSFs as a sector from which youth are encouraged to move away from rather than drawn into, continuing with their intrinsic heritage.
Ecosystem productivity	● Declining fish stocks directly impact SSF fishers as they rely upon stock predictability and productivity for their livelihoods (FAO, 2022). ● Climate variability and human impacts (pollution, overfishing) have a direct relationship with declining ecosystem productivity, which also has a direct effect on intensifying fishing efforts to cope with change. ● Varying and declining ecological productivity in certain ecosystems may be a driver for youth to pursue alternative livelihoods to SSFs.
Inadequate and discriminatory working conditions	● SSF and aquaculture are physically intensive activities, requiring multiple actors working under hard conditions with strength required. These conditions cause youth, and even child labor, to be assigned different activities in the value chain, which can be underpaid and undervalued work. ● Women play critical roles in fisheries and aquaculture, such as processing and retailing activities of the value chain, but often face vulnerabilities associated with their gender, including sexual harassment and in some cases, even violence, limiting their ability to benefit from SSF work (FAO, 2022).

Adapted from Arulingam *et al*., (2019).

2.1.b Opportunities

Youth experience many challenges in small-scale fisheries and aquaculture, limiting their involvement and motivation, which results in unrealized potential for a decent livelihood with positive and sustainable development opportunities (Fry *et al*., 2021). Under the right conditions, SSFs and aquaculture can be great opportunities for development, inclusion and alternative livelihoods for the youth living in remote and natural ecosystems, predominantly on coastal marine zones.

Arulingam *et al*., (2019) describe opportunities for youth in SSFs and inland aquaculture as the following:

Opportunity	Description
Job opportunities	● Limited literature and information is available to understand youth participation in aquaculture; however, Arulingam *et al*., (2019) identified that at specific scales and certain contexts such as in Asia, youth are significantly employed in this sector. ● The growth of inland aquaculture in particular in response to an increasing global demand for fish is a potential driver for youth participation. ● In Myanmar's Ayeyarwady Delta (Inland SSF), youth have an aspirational view towards profitable, alternative and sustainable livelihoods (Fry *et al*., 2021). Different opportunities for youth arise along the value chain, such as jobs in processing, marketing, trading and communication, especially as connectivity is improved between rural and urban areas. ● More studies are needed to understand the potential of youth participation in SSF and aquaculture jobs, particularly regarding the value chain entry points for youth and appropriate working conditions.
Adopting new knowledge and technology:	● Youth characteristics include agility, responsiveness, innovation and adaptation to changing conditions, including the ability to cope with technological advances. However, the ability to cope with technological change is directly linked with educational background.

	● Both the SSFs and aquaculture sectors integrate technological advances to increase their productivity, which can make them more attractive for youth. ● As noted by Arulingam *et al*., (2019), further studies and information are needed to properly identify these opportunities.
Interventions by the government and stakeholders:	● There are multiple opportunities to promote youth engagement in the SSF and aquaculture sectors; however, support needs to come from external agents such governments, development organizations, research institutions or the private sector. ● Examples of this are public funding for SSFs and aquaculture projects, knowledge and skills building programs for youth, opportunities for exchanges, and more. Initiatives to enhance youth engagement mandate a systematic and cohesive response from national governments, private companies, development partners, research institutes, and youth organizations (Fry *et al*., 2021).

Adapted from Arulingam *et al.*, (2019).

2.2 The State of Education in SSFs

There is very little data available on education in small-scale fishing communities and those involved in aquaculture. Apart from several pioneering case studies, not much literature is available on the status of education for youth directly or indirectly related to fishing families in developing countries. Santhakumar and Kurien (2019), present a preliminary assessment of the educational structure for children from fishing families in developing countries, providing insights on schooling for children and access to appropriate education; however, there is a need to further investigate this context to have a more profound understanding.

Investigators can acquire inferential knowledge from research in land-based agri-food systems and their communities. However, it is essential to stress the heterogeneous nature of rural villages and the vast differences between agriculture and fish-dependent communities. Historically, fishers have been found to be more poor and exploited in their work in comparison with similarly laborious activities such as land-based agriculture or food production (Santhakumar, Kurien, and Devi, 2018). Moreover, human development indexes

among fishers are lower than the average for similar rural conditions (Santhakumar, Kurien, and Devi, 2018). Further investigation is needed to identify the relevance between the state of education in rural areas of developing countries and their potential relationship with SSFs challenges for development opportunities.

Based on the reviewed literature, there are critical overlapping issues concerning education in agriculture and fishing communities. These include low quality education, limiting access and incentives for secondary education and leading to high dropout rates among youth. In addition, SSFs and aquaculture are labor intensive activities, where family units often need their children's involvement (de Fraguier Niels and Halfwassen, 2019).

The early age of initiation in fishing activity by young people in traditional communities has a negative effect on participation of education programs, influencing the level of education that can be obtained (Vieira, Morales, and Nunes, 2012). There is a need for educational programs to be flexible, considering fishing family conditions to accommodate participation in education, and reduce the levels of dropout due to participation in fishing activities.

Educational programs need to meet traditional knowledge in SSFs communities in a manner that responds to their priorities and needs. For example, youth from the Bonifacio village in the Amazon understand complex ecosystem dynamics and can associate target species with specific fishing grounds, reflecting the intimate relationship of SSFs communities with their environment (Vieira, Morales, and Nunes, 2012).

In fishing communities, traditional practices imply that young boys must build their capacity for marine fisheries at an early stage, collaborating with their parents in fishing activities and impacting the way they attend school. For example, traditional skills such as boat navigation skills, sailing operations and maintenance, and casting nets are learned by doing, requiring tutorship from older fishers to younger fishers (Santhakumar and Kurien, 2019).

Young women traditionally have different roles in SSF communities. Girls are often involved in activities associated with fishing, like mending nets, cleaning gear and supplies, or participating in marketing or processing activities. They are also directly linked to household chores that support the family context.

These roles for both young men and women within fishing communities traditionally result in educational under-achievement (CRYD, 2015). Formal education needs to be paired with ecological and traditional forms of knowledge to be beneficial for youth. Overall, synergies are needed to promote natural-cultural heritage (Arulingam *et al*., 2019).

Artisanal fishing villages are predominantly located in rural remote areas, with insufficient infrastructure (water access, sanitation, communication) and public services (education and health) (Allison and Horemans, 2006; Westaway, Barratt, and Seeley 2009). Westaway, Barratt,

and Seeley (2009) argue that rural conditions of fishing communities, including lack of infrastructure, remoteness and isolation, aggravate the persistent challenge of accessing educational facilities, furthering the obstacles for quality education (Westaway, Barratt, and Seeley 2009). For education, standards could be enhanced by improving enrollment rates through adaptive curriculums and flexible access for students. In developing countries, there are high success rates for education policies that are connected to inclusive societies which enable social transformation and increase of equitable opportunities (de Fraguier Niels and Halfwassen, 2019; Education Policy Guide, 2012).

Artisanal fishing youth have not been considered as a sector with their own voice. In order to raise their demands and interests in public policies to improve the levels of educational, cultural, economic and social access, and to guarantee their human rights, organization is needed. There is a demand among fishing youth for access to opportunities for education, training and learning in technical occupations, as well as for entrepreneurship projects to promote sustainable use of resources (Cruz, Sáenz and Rivera, 2016). Existing policies to increase youth participation and employment in fisheries and aquaculture tend to focus on two goals: capacity development interventions and youth entrepreneurship (Fry *et al.*, 2021). Capacity development often narrowly focuses on individual shortcomings versus the underlying mechanisms that act as barriers to youth's involvement in the labor market. While valid, youth entrepreneurship remains poorly understood (Fry *et al.*, 2021).

The barriers to youth engagement in SSF, like in other agri-food systems, are often amplified by different intersectional identities. Young people's opportunities are frequently condensed into informal, poorly paid, and often stigmatized segments of SSF and aquaculture value chains. Otherwise, youth tend to assume supportive roles within household production (Fry *et al.*, 2021). Like other agri-food systems, education is one of the most critical gaps for youth involvement in wild-caught fisheries or fish-farming, alongside skills, networks, infrastructure, access to innovation and technology. The intersection of these gaps with structural barriers in labor markets and minimal access to entrepreneurship opportunities, result in a compounding effect that restricts the growth of youth opportunities (Allison, 2021).

Traditional pedagogical approaches and national curriculums reduce young people's exposure to ecological and conventional forms of knowledge related to livelihoods in small-scale fisheries or aquaculture (Fry *et al.*, 2021). Rural students typically are unable to learn in engaging education environments as resources lack.

2.2.a Recommendations

Key recommendations taken from the literature on the status of rural youth that can be adapted to fit the needs of those living in fish-dependent communities include:

- Heterogeneous educational approaches for diverse and specific communities, with the prioritization of “learning by doing” programs;
- Inclusive learning practices;
- Entrepreneurship and creative thinking;
- Fostering educational programs within communities and governance structures as a means to recruit and increase youth participation;
- Available and transparent sources of information targeted for youth of relevant socio-economic situations in rural and remote areas;
- Provide access to non-traditional educational programming, including creative, interactive, or audiovisual learning opportunities (Jivetti, Njororai Simiyu, Njororai, 2016)

Much of the current body of knowledge recommends pathways for youth to become more “productive” members of societal or agri-food systems. There is ample space for holistic discussions on positive development of youth as individuals with agency, aspirations, emotions, ideas, and relationships with their built-natural environments shared with nonhumans.

2.3 Rural Education and Environmental Pedagogies

2.3.a Rural Education

Environmental pedagogies are experiential and place-based, bridging science and storytelling, while considering social and ecological justice.

Researchers have not looked closely at the diversity of rural communities in the context of educational programs. Rural communities range from urban-adjacent suburbs to small, isolated islands (Corbett, 2021). When designing educational programs, the heterogeneous nature of small-scale fisheries communities and rural schools is crucial to consider. Additionally, rural education is more complicated than simply engaging young learners in exploring their natural and built environment. Rather, the quality lies in connecting various layers of a place, from village or ecosystem to society and the planet, thus encouraging young learners to appreciate their local realities in the context of global change (Corbett, 2021).

Community involvement is a central consideration within rural education, as is the role of NGOs to connect the broader community to educational spaces and opportunities.This was noted by Fraguier Niels and Halfwassen (2019) in a graduate thesis, which examined the state of rural education in Ethiopia and explored different youth empowerment methods for educational incentives to contribute to the holistic development of young people.

Innovative educational methods that reinforce the connection between schools and communities strengthen youths’ ability to develop advocacy and social movements to

impact sustainable change (Fraguier Niels and Halfwassen, 2019). Patterson *et al*., (2009) were aware of the potential of this connection when introducing adult education in five coastal SSF villages on the Tuticorin coast in India in 2007. The program for SSF people included “environmental education practices, including conservation of natural resources, particularly coral reefs and seagrass habitats, its importance and role, the need for conservation and management, eco-friendly fishing practices, and sustainable use of fishery resources.” They utilized the existing organizational structure of Women's Self-Help Groups to organize and identify participants for educational workshops, specifically women (240 women, 44 men). Literacy was improved from non-existent to the ability to read transportation schedules, enabling solo travel. Basic information about their ecological system was learned, including that corals are living animals that provide habitat to reef life and protect coastlines; the significance of healthy corals for healthy coastal fisheries (in the International Year of Reefs, 2008). Methodologies included group discussions and 'entertainment' in the form of songs, folk dances, drama, and quizzes. Schoolchildren were included for portions of the education along with their parents (Patterson *et al*., 2009).

Education impacts social inclusion. Three critical aspects of ensuring broader social inclusion in the education sector include: accessibility, engagement, and empowerment (de Fraguier Niels and Halfwassen, 2019). Participants in de Fraguier Niels and Halfwassen (2019) reflected on the benefits of the application of these three aspects, combined with the inclusion of learning practical skills rather than strictly theoretical information.

Access to education that provides students with practical skills is essential for encouraging youth to return to school after dropping out. If schools were supplied with adequate materials and supported in their basic needs, it is likely student dropout rates would decrease and youth would be more prepared for future opportunities such as securing employment (de Fraguier Niels and Halfwassen, 2019). However, lack of government support has led to under-resourced schools and education systems overall. It is important to understand the impact this has on dropout rates (de Fraguier Niels and Halfwassen, 2019).

Students have identified two other major obstacles to achieving financial independence and success in the labor market: a lack of available jobs and financial resources (de Fraguier Niels and Halfwassen, 2019). In rural areas, these factors are not only intensified, but there is also a lack of understanding and awareness of these issues as they relate to youth and education (de Fraguier Niels and Halfwassen, 2019).

When considering the 17 Sustainable Development Goals (UN SDGs, 2015), resilience is understood as “the capacity for vulnerable individuals, in this case at risk of harm regarding important issues related to poverty and education, to recover from difficulties and problems faced”. This must be a guiding element to improve educational standards in the form of better policy and implementation (de Fraguier Niels and Halfwassen, 2019; Ethiopian Development Research Institute, 2018).

There are various ways to approach education focused on practical skill development. de Fraguier Niels and Halfwassen (2019) highlight Harmee Education for Development Association in Ethiopia, as an example. This approach provides young learners - labeled as "school drop-outs" - with practical training while they wait to retake the school entrance exam the following year. Feedback from youth participants in these programs is positive. These students thrive in a "learn by doing" model focused in different sectors. Practical sectors identified by de Fraguier Niels and Halfwassen (2019) include: agriculture, handicrafts, horticulture, information technology, and metalwork (de Fraguier Niels and Halfwassen, 2019). These hands-on learning experiences tend not to be offered by formal educational curriculums. Often referred to as *second-chance education centers*, these social centers are often held to different curriculum standards than formal education institutions. Therefore, they can often be more innovative and responsive in their approaches for high student retention rates.

The Sebastian Indian Social Project (SISP), located in Trivandrum, Kerala, India, has delivered a free Second-chance Education program for young children and adolescents from the most impoverished communities in the area; artisanal fishing villages. SISP motivates students to attend classes during the week by offering an after-school skateboarding program and weekend surf classes for those students with daily school attendance (Kovalam Surf Club, 2022). SISP also provides social care and support for young adults for finding meaningful work in their communities. Since SISP's establishment in 1996, the second-chance education center has put thousands of students back into traditional schools with successful graduation rates. Many students have gone on to college with scholarships or pursued vocational careers (SISP, 2022).

2.3.b Environmental Pedagogies

Environmental Education (EE)

Many definitions for Environmental Education (EE) exist. Villacrés and da Silva (2019) define EE as rooted in cognitive theories stating that focus on ecological issues will foster responsible attitudes and pro-environmental behavior change. In the process, young learners improve their capacity for observation and analysis.

EE is related to the construction of a new environmental culture, through the establishment of a doctrine or mentality of environmental thought; the diffusion of an environmental ethic; and the capacity to act and implement environmental management projects.

Fundamental to EE are, "ocean education, literacy, marine resources valuation, as well as environmental behavior and attitudes development towards ocean sustainability, ocean stewardship, and marine citizenship" (Carvalho *et al*., 2021). An increasingly recognized goal of EE is understanding and encouraging learners' attitude development through participation.

Common Worlds Pedagogy (CWP)

Common Worlds Pedagogy (CWP) focuses on shared worlds and young learners' connections with materials, energies, and species beyond the self and beyond humans (Talyor, 2013). Common worlds affords agency to both humans and non-humans, thus allowing for a shift from individual learning to learning as a collective endeavor within a young person's built-natural environment (MacAlpine *et al*., 2020). The principle of connectedness moves young learners to imagine with those around them and explore their actions and reactions in the context of relationships with others as young people begin to think of themselves not as isolated parts or individual actors. It is an attempt to become worldly (Taylor, 2013).

CWP encourages inclusive thinking that reframes the often stark distinction between human societies and natural environments. This pedagogy works to aid the development of understanding of ourselves within indivisible common worlds, specifically through focusing on how "our past, present and future lives are entangled within those of other beings, non-living entities, technologies, elements, discourses, forces, landforms" (Plastic Childhoods, Pedagogical Orientations). By reimagining many fundamental elements of traditional education, CWP challenges educators to expand the view of education to consider how to shape or model different ways of interacting with the world. This mindset nurtures interpretive and symbolic thinking, encouraging children to foster closer relationships to the world around them.

Plastic Childhoods helps establish the bounds of the development of this SSF Curriculum from the commitments to the activities we prepare, for and with the communities. This source is important as it conceives a curriculum that is not fully predetermined but emergent (Plastic Childhoods).

As a common theme throughout the pedagogies discussed, it is important to note that the CWP cannot be approached from a technical, strictly information sharing perspective. Rather, these practices are rooted in connectivity through idea sharing, collaborative thinking and creating, focusing on both creative and critical thought processes, and prioritizing learning that helps to create "complex logics and innovative rationalities" (Plastic Childhoods, Pedagogical Orientations).

Bioegalitarian Pedagogy

A unique pedagogical approach is presented by Stewart in *A Murray Cod assemblage: Re/considering riverScape pedagogy*. The author provides an account of a bioegalitarian pedagogy (Deleuze and Guattari, 1987), while working in southeastern Australia's Murray-Darling Basin (MDB) with a group of college-age students in various interactive modalities to explore the 'Murray Cod assemblage' (Stewart, 2018). Murray Cod (*Maccullochella*

peelii) is a predatory species of freshwater fish, and the assemblage is the conceptual framework of all the species and environmental factors surrounding the species.

Stewart stresses, “never has there been a more pressing need to think differently about how humans conceptualize and relate to the more-than-human world”. Through this research, or ‘thought experiment’ and teaching strategy, Stewart (2018) understands the bioegalitarian pedagogy as viewing oneself as “becoming-animal and becoming-minor (Deleuze and Guattari, 1987), through deterritorializing human/animal/riverScape relations” (Stewart, 2018).

The author led pedagogical discussions with students that shifted from the Cod, to industrial water use, management, and politics, to floodplains in a state of drought. Students connected the seemingly disparate experiences of canoeing and camping through the riverScape by discussing how Murray Cod have agency, yet their activities and survival are impacted by human activities, as well as the use and management of the river and waterways.

Related to Stewart’s approach of encouraging creative and progressive understandings of species and natural environments, Todd (2017) explores this concept in *Fish, Kin, and Hope: tending to water violations in amiskwaciwâskahikan and Treaty Six Territory.* Following an oil spill in Canada’s North Saskatchewan River, Todd implores readers to reconsider how we define and engage in human and more-than-human relations. In the context of ecological upheaval in Indigenous Territory in what is currently known as Canada, Todd questions the role of fish-as-political-citizens. Understanding fish to be nonhuman persons, the author places fish within the legal-political landscape of Indigenous resistance in Canada (Todd, 2017). Though the paper expands from this curriculum, it reorients our perspective to the larger structures of extraction and how they weaponised the material they extract. In the case of Todd’s paper, oil, in the context of this curriculum, fish over-extraction (Todd, 2017).

Adventure-based Learning (ABL)

ABL enables self discovery and team building by providing educational challenges, both physical and intellectual, that require problem solving. Through hands-on activities, groups work together to explore leadership, collaboration, conflict and team support. This experiential training allows for in-the-moment decision making, which is later reflected on through a debriefing process including an analysis of effectiveness, goal setting and an overall review of group dynamics. Additionally, skills and educational outcomes gained through ABL, including self confidence and determination, can provide learners with an important foundation to enable successful future educational and life experiences (Adventure-Based Learning, 2022; Outdoor Queensland, 2022).

Fialho (2007) states that in children, thoughts are closely linked to action so “they learn by doing and learn by thinking about what they did,” thus the promotion of a “ learning centered on action and reflection on action itself” is highly recommended.

Social-Emotional Learning (SEL)

Mitchell (2021) characterizes SEL as "the process of teaching students to appropriately manage relationships and make ethical decisions while simultaneously being socially cognizant, self-aware individuals” (Mitchell, 2021, p. 96). Through SEL, young learners develop self-awareness and gain the tools to make well-reasoned decisions (Mitchell, 2021). This approach to education positively impacts learners’ social, emotional and cognitive development and is most beneficial when the principles of SEL are accessible to students through various avenues within their community, and encourages interactions “between educators, SEL curricula, parents and local resources” (Mitchell, 2021, p. 101).

Youth-led Participatory Action Research (YPAR)

YPAR is an unconventional, progressive approach to learning positive youth development (PYD) and community development, through which students are taught how to organize systematic research with the goal of bettering their communities, lives and relevant institutions (YPAR, 2022). YPAR is defined as “a cyclical process of learning and action” where research is done to inform potential solutions to real problems that young persons care about or may endure for themselves (Ozer *et al.*, 2020; YPAR, 2022). YPAR can be a compelling approach for youth experiencing marginalization due to racism, sexism, homophobia, classism, ableism, or other forms of oppression and discrimination (YPAR, 2022).

Education for Sustainability (EfS)

EfS is described as an “educational practice that results in the enhancement of human well-being, conceived in terms of the expansion of individuals’ agency, capabilities and participation in democratic dialogue, both for now and for future generations” (Landorf, Doscher and Rocco, 2008, p. 12). There are three main elements of EfS that work together to empower sustainable change: community education, public awareness, and training. EfS is an important concept based in active learning that utilizes education as a way of achieving the UN Sustainable Development Goals (United Nations, 2015). EfS empowerment stems from the role that the community plays in engagement and knowledge sharing (de Fraguier Niels and Halfwassen, 2019). De Fraguier and Halfwassen (2019) views the current approach to formal education as reproducing an unsustainable society, and believes that EfS can enable a necessary change towards sustainable education. EfS and other emerging, non-formal education models involve active learning theories. Through active learning, students take an active role in their learning processes, enabling greater participation in the development of a body of knowledge cooperatively with the educator (de Fraguier Niels and Halfwassen, 2019; Sustainability in Schools, 2022).

Positive Youth Development (PYD)

PYD progresses away from the reactive, conventional approaches to engage young people through an at-risk or problem-focused framework. Rather, PYD promotes collaboration with youth to proactively build upon the skills they or their communities already possess, foster healthy relationships within their natural-built environments, and support young men and women to take active roles as leaders and partners in development efforts. PYD posits that if youth acquire the knowledge, skills, and support required, they will thrive as healthy, capable adults to make meaningful contributions in their lives and communities (Alvarado *et al.*, 2017).

Design-Oriented Pedagogy (DOP)

Design-oriented pedagogy (DOP) offers a framework to create new learning ecosystems (Vartiainen *et al.*, 2012). This pedagogy is based on community participatory learning, the use of technological resources and infrastructure as social and personal tools, and the use of co-development as an instructional model. DOP is founded on project learning as discussed in depth by Krajcik and Blumenfeld (2005) and the idea of self-organizing systems established by Ashby in 1962 (Anu, Enkenberg and Pöllänen, 2014).

Within DOP, a learner experiences both the role of designer and researcher. In this way, DOP is similar to inquiry-based pedagogies. For example, in the European Commission inquiry-based learning project, weSPOT, learners perform both the roles of explorer and scientist. Motivated by their personal curiosity and guided by self-reflection, learners develop knowledge, personal and collaborative sense-making, and reasoning (weSPOT, 2012; Anu, Enkenberg and Pöllänen, 2014)

Anu, Enkenberg and Pöllänen in their 2014 paper ask the question: “What do the digital stories reveal about the emerged learning ecosystem and learning processes?” (p. 588). Using a DOP framework to build new learning ecosystems, the authors include a breakdown of DOP principles (3) and pillars (6). Young students in a rural village school in the lake district of Eastern Finland (age 6-12, n=32) were tasked with inquiry-driven learning that resulted in the creation of digital videos to explore questions of their own design surrounding the trans-disciplinary phenomenon of winter fishing within a DOP framework (Anu, Enkenberg and Pöllänen, 2014). The authors argue the inquiry-driven tasks encouraged students to discover strategic knowledge in order to understand, translate, and communicate the complex processes in question. The students collaboratively produced digital stories in small groups, which were then analyzed to evaluate the emergence of the ecosystem and confirm that students’ agency in DOP resembles that expected of 21st century learners. This co-development of local knowledge through storytelling can include children from the age of 6 onwards (Anu, Enkenberg and Pöllänen, 2014).

Nature-Culture Constructs

There has been an inability within the science education field to develop educational curriculum to engage minority groups and women. Cultural relations are one reason this issue persists. The achievement of equity in science education is dependent upon new ways of learning that can disrupt the current inequity and an open mind to understand the relations between nature-culture-community and ecosystem that drive education (Bang and Marin, 2015) . Authors Bang and Marin (2015) worked with an urban Indigenous community to test dynamics to achieve science education equity and structure ways in which children and teachers build bridges between the natural world and cultural forms of life.

The above paper expands this curriculum's conception when teaching, for example, about water within the nature-culture understanding. The methodology considers the historical context, the knowledge of the elders, the community, and their relationship with nature when teaching about the environment. As stated by Bang and Marin (2015), it is important that the classroom does not push youth away from their culture and their community, instead emphasizing that students and community members be included in the design of desperately needed environmental solutions. The results show that when teachers used the proposed methodology, learning improved for the Indigenous youth.

Another example by Kawagley and Barnhardt (1998) provides positive results for Indigenous communities who are called upon to contribute to science education with their community-based knowledge. The authors present a comparison of Alaskan Native and Western worldviews in the context of education, from the perspective of Alaskan Natives who have experience interacting with Western-educated fishery and wildlife managers. While dated, citing experiences from 1989, this comparison illuminates the value of holistic Indigenous worldviews to scientific understanding of changing ecosystems.

The Alaska Native worldview approaches to education begin with the five elements of the universe-earth, air, fire, water and spirit. Each of these elements is stated as “gift to the life-giving forces of the living earth.” In a practical way, the school curriculum includes indigenous knowledge like language, culture, science, arts and relates these subjects to the earth elements. The indigenous worldview gives humans a secondary role in the Nature scenery. It is again a biocentrism approach instead of anthropocentrism (Kawagley and Bernhardt, 1998). This comparison highlights the biocentrism approach, instead of the anthropocentrism most common in education.

Nxumalo’s (2021) study, *Decolonial Water Pedagogies: Invitations to Black, Indigenous, and Black-Indigenous World-Making,* further contributes to the CDWG’s consideration of nature-culture constructs. Revisiting the biocentrism approach, it questions how hegemonic pedagogies around place-based learning portray nature as a muted landscape, thus reinforcing colonizing and extractive views of the world where nature is valued primarily for how it can benefit certain humans. Nxumalo focuses on a project with children and

Indigenous elders, where they practice pedagogies of reciprocity. Thinking about what water does to us, instead of what we can use water for. The project also centers pedagogies of relationality enacted through collective ceremony that disrupt anthropocentrism.

These practices are useful to the SSF curriculum's theoretical framework, and also provide a tangible example of activities that push children to engage with nature from a less human-centered lens. They also push this project to engage with Indigenous epistemologies and decolonial knowledge in order to build a more reciprocal relation to earth-elements, other-than-human and nature.

Local Wisdom-Based Learning

The implementation of culture-based learning can incorporate mathematical concepts. In the field of ethnomathematics, everyday aspects of children's lives, such as their local small-scale fishery, can be leveraged to learn mathematics. Sulaiman *et al.*, (2021) examine the role of culture, students' daily lives, and mathematics instruction through local wisdom-based learning approaches. Authors argue that when young learners are challenged by concrete problems reflected in their reality, they feel an impulse to find solutions rationally and think critically about the impacts.

In their study, Sulaiman *et al.* (2021) examined the application of ethnomathematics in Bondet village, a SSF community in Gunung Jati sub-district, Cirebon Regency, Indonesia. Researchers specifically were interested in the use of fishing equipment in teaching young learners mathematical concepts. Passed down through generations of fishers, the process of making fishing nets incorporates geometrical principles that young people learn from elders outside the classroom. Besides the discovery of mathematical concepts, students gain a deeper understanding of their cultural understanding and families could be more inclined to keep their children in school given the real implementation of acquired knowledge within the fishery. The material becomes easier to study due to its direct relation to daily activity.

An education rooted in local wisdom is an integral part of Indonesian culture. To implement such wisdom-based education, coordination and support are required between the central government, regional education directives, educators, and families. With this support, educators can leverage the culture and local wisdom of their area to teach students mathematical concepts.

Justice-Oriented Science Pedagogy

Justice-oriented science pedagogy considers the issues of human rights and environmental justice. Learning to live sustainably requires acknowledgment of the exploitation of people and places (Davis and Schaeffer, 2019).

Connecting lived-experience with curricular design provides a framework for the world of science and sociality to go hand in hand. The authors use Justice-oriented science pedagogy as a map for teaching K-12 students in Flint, Michigan, USA, about water. Flint, Michigan is infamous for its water crisis and known as an example of a sociopolitical context where environmental issues pose a direct threat to human health.

The study of water as a science idea frequently separates it from its deeply political history as a limited, compromised or intentionally withheld resource. A body of literature exists critiquing decontextualized and depoliticized pedagogies, and calling for science-learning environments with the lenses of equity, historicity, and power. However, more insight is required to understand how children develop within socio political contexts where environmental issues pose a direct threat.

The authors report findings from a 2-year study investigating Black student agency in a school with a place-based design, presenting the project with a focus on water as a human right and from a social justice perspective. This entailed looking not only at water's scientific composition, but also the cultural, sociopolitical and experiential meaning of water. The authors found that children's meaning-making on the topic broadened from individual accounts to explanations of systemic environmental justice issues (Davis and Schaeffer, 2019).

2.4 Environmental Curriculums

Key Objectives for the SSF Guidelines Curriculum

Based on reviewed sources, the overall goal of this curriculum is to develop in learners a deeper, more nuanced appreciation of their built-natural environments; of the place where they are living; of its social history; of the biodiversity that exists there; and of how people have responded and continue to respond to their natural and social environments.

From this foundation, this curriculum must achieve the following to effectively meet the needs of young learners and their fish-dependent communities:

- Address early drop-out rates among students who leave to seek paid work or feel they have "had enough school" by enabling students to see the value in their education as a pathway towards earning more money or agency in the future.
- Establish connections between academic learning and real-world challenges and opportunities through place-based education. This includes ensuring that in-school education aligns with the real-life complexities experienced by students through an "integrated, interdisciplinary, and frequently project-based approach where all learners are accountable and challenged." (Te Kete Ipurangi, 2022)

- Offer young learners opportunities to engage with decision-makers and in managerial processes, exploring possible avenues to increase young people's participation in the sustainability of their local fishery.
- Increase awareness of the SSF Guidelines among young people, local educators, and fishing families while involving youth in monitoring the implementation of the SSF Guidelines.
- Evoke curiosity and enable students to generate nuanced data about their SSF, using the local community and environment as a starting point to share concepts mirrored in the SSF Guidelines.

Education Initiatives in Fishing Villages Engaging Young Learners

The literature largely describes community engagement initiatives targeting adults on the sustainable development of their fisheries with a particular focus on developing Community-based Ecosystem Approaches to Fisheries Management (CEAFM). According to a 2010 report by Secretariat of the Pacific Community in collaboration with FAO and the Nature Conservancy, CEAFM seeks to incorporate the participation of community stakeholders to ensure that future generations will continue to have access to the benefits associated with sustainable fisheries and healthy ecosystems (Bianchi *et al.*, 2010).

However, what educational opportunities exist for the youngest generation to participate in the co-creation of their own sustainable, healthy futures? Could young people's participation contribute to the likelihood of secure tenure, responsible resource management, social development, gender equity and other themes outlined by the SSF Guidelines in the context of food security and poverty eradication?

While a number of education initiatives exist that specifically target youth regarding the conservation of their marine ecosystems and aquatic biodiversity, there is a gap in addressing these young learners as small-scale fisheries rightsholders and entrepreneurs engaged in co-creating the future of their fish-dependent or related communities. Various studies have shown that youth are often more receptive than older generations to learning about and becoming involved in new approaches and technologies related to resource conservation in small-scale fisheries and interconnected social-ecological systems (Arulingam *et al.*, 2019; Fry *et al.*, 2021; Espinoza-Tenorio *et al.*, 2022)

One example of youth leading a community-based resource management (CBRM) initiative took place in the Solomon Islands. A youth group observed how beneficial this approach to action could be in a nearby community, where they witnessed the positive impact that a kastom arrangement had on a coral reef-based ecosystem and were eager to try to adopt this arrangement in their own community. A kastom arrangement is "a customary structure where coral reefs are protected from fishing for specific periods during the year" (Abernethy *et al.*, 2014). In the past, the majority of youth from this community had struggled deeply with various complex problems including alcoholism. Thus, when this youth group proposed

CBRM in the form of a kastom arrangement for their own community reef, it was extremely well received by the community elders. There was a general agreement from the community that this type of involvement with the environment and leadership over an initiative would inspire an increased sense of connection and responsibility among youth. After learning more information from discussions with NGOs, the youth group assembled and mobilized a Youth Conservation Committee that facilitated weekly sessions during church for almost a year. These sessions served as a way to increase community involvement and disseminate information about the benefits of their initiative to protect the reef (Abernethy *et al.*, 2014; Fry *et al.*, 2021; Arulingam *et al.*, 2019).

Another example comes from a community in Ghana, where limited funds are available for the proper operation and maintenance of wastewater treatment plants. A CapVal project (Creating and Capturing Value: Supporting Enterprises for Urban Liquid and Solid Wastes Recycling for Food, Energy and Clean Environment) was implemented in 2015 with support from the International Water Management Institute (IWMI) (Arulingam *et al.*, 2019). The production of catfish (*Clarias gariepinus*) with the use of treated wastewater was tested as a pilot project and designed to use catfish production as a means of income generation for improved wastewater treatment (Fry *et al.*, 2021). The production of catfish in this way could help to raise funds for wastewater treatment, create employment opportunities for local youth, and increase the supply of catfish for the market. A public-private partnership framework was used to implement the project, in which the government owned the ponds, and the private entity provided offices, a hatchery, and business and technical advice. The business was run by a young entrepreneur who produced catfish fingerlings, reared them in ponds, and sold them on the market. This business requires both skilled and unskilled labor, and created employment for five to seven young people (Arulingam *et al.*, 2019).

The MzanSea Revealing South Africa's Marine Ecosystems Project is an ocean literacy initiative to connect South Africans to their marine ecosystems. The MzanSea promotes ocean literacy by producing resources on South Africa's coastal and marine ecosystems for educators, scholars, and decision-makers. The dynamic approach and student-oriented methods for content delivery rest on a foundation of aesthetically captivating imagery and enchanting illustrations. The project inspires how this curriculum-in-development can present ecosystems knowledge to encourage understanding and simultaneously support knowledge exchange where students could share traditional communal knowledge, feel supported by the natural sciences, and use the SSF Guidelines as a map. With collaboration with One Ocean Hub, the CDWG could share MzanSea as supplementary material accompanying this curriculum for SSF communities educators in South Africa (MzanSea, 2022).

Coast 2 Coast Movement

As our planet experiences dramatic social and environmental challenges, it is communities living along the coastlines where livelihoods are most affected by climate change and marine degradation due to rising sea levels, plastic pollution, overfishing, and industrial activity.

These villages face a twofold problem: lack of capacity to have their perspectives heard and barriers to receiving information on potential drivers of and adaptations to change (Betzold, 2015).

The Peruvian nonprofit, Coast 2 Coast, presents a new approach to “learn by doing” outside of a conventional classroom for youth in fishing communities around the world. This initiative by the non-profits, Beyond the Surface International and Lobitos Cinema Project, partners with local schools, social projects, environmental nonprofits, and community-run organizations in SSF communities to engage rural youth in exploring their ancient waters and ancestral villages as resilient researchers and skilled communicators. engage local youth from small-scale fishing villages to develop key communication skills through media and visual arts workshops, as well as critical thinking skills through community-based investigation. Students learn how to use transmedia tools, apply community-based participatory research approaches, and impact storytelling techniques to illustrate their SSF’s importance for healthy aquatic social-ecological systems.

Coast 2 Coast’s transdisciplinary team engages local youth as impact storytellers through photography, photojournalism, comic, stop-motion animation, street art, murals, filmmaking and novel “edutainment” weeklong workshops, 6-month programs, and touring school festivals that foster digital literacy, geospatial knowledge, entrepreneurship, and awareness around the SSF Guidelines.

Guided by the SSF Guidelines, young learners identify their fishing villages’ strengths, investigate changes, daylight challenges, and brainstorm potential solutions. Participants co-create their own stories rooted in traditional knowledge, fortified by science, and expressed through students’ imaginations that highlight their ocean and community as a marine social-ecological system. Through partnerships, we work to implement these youth-driven, community-based solutions for healthy seas and SSF communities.

Coast 2 Coast acts as a platform for small-scale fishing communities to celebrate their existence and share with the outside world about the unprecedented social and ecological challenges they are facing on a daily basis.

3. Community Level Implementation of the SSF Guidelines with a Focus on Youth Uptake

Over 4,000 small-scale fisheries actors and a diversity of other civil society representatives from over 120 countries collaborated with FAO to create the SSF Guidelines, officially approved as an international instrument in June 2014 by FAO Committee on Fisheries (COFI) (FAO, 2022). The majority of SSF actors to participate in the Guideline's development were women and men directly involved in capturing aquatic food sources or in pre-harvesting and post-harvesting processes. Civil society representatives included those from social welfare nonprofits, local environmental projects, indigenous peoples' associations, trade unions, and a variety of support groups, including industry representatives and members of academia. These actors played significant roles in shaping the contents and language of the original drafts of the SSF Guidelines, constructing the framework for the final negotiated texts while actively participating in the negotiation processes (Kurien, 2022).

Once UN documents are approved, there are often dedicated UN agencies who lead the process of adding technical constructs as user guidance for implementation or practical purposes (Kurien, 2022). There is a particular focus on uptake among stakeholders at the local level. As Kurien describes, the mobilizing agencies share monitoring procedures so that stakeholders' feedback on implementation processes is recorded and considered through proper channels. This is most critical at the national level to determine if States are fulfilling their commitments to the SSF sector through awareness-raising and implementation efforts around the voluntary guidelines.

There is a concentrated effort by FAO, as the lead UN agency promoting the guidelines, to work with global partners including multinational institutions, nonprofit organizations, and community-based initiatives, to support uptake by stakeholders acknowledged in the voluntary guidelines to move towards implementation at the community level. The approach is done through a variety of formats.

FAO facilitates regional consultation to discuss implementation of the SSF Guidelines. This is in step with Paragraph 13.6 of the SSF Guidelines which encourages the co-creation of regional plans of action for implementation (Franz *et al.*, 2016). In these consultations hosted by FAO, participants from government and non-governmental organizations meet to discuss the current status of small-scale fisheries in the region, share experiences through topical presentations, and explore priorities and actions for implementing the SSF Guidelines at regional and national levels, in support of existing regional frameworks (Franz, Smith and Westlund, 2019). The consultations often result in suggestions for key priority areas that national and regional implementation planning agendas must consider further in addition to articulation of next steps and actions items for different actors.

Digital platforms like the *Small-Scale Fisheries Resource and Collaboration Hub*, or SSF Hub, also lead efforts towards implementation. As an "online, interactive, and multilingual platform," the SSF Hub serves to provide open access tools and free resources for small-scale fishers, fish workers, and their communities and allies. The goal is to strengthen artisanal fisheries management and community development. As an intentional, cooperative space, the SSF Hub's mandate is to work with small-scale fishing communities and allies to implement the SSF Guidelines (SSF Hub, 2020).

International research networks such as *Too Big to Ignore* (TBTI), are also committed to ensure the implementation of the SSF Guidelines. Through research clusters comprised of over 600 researchers from over 20 different organizations in over 60 countries, TBTI facilitates in-depth, transdisciplinary research, centered on improving the understanding of various aspects of small-scale fisheries from coast to coast (TBTI, 2023). TBTI argues that a transdisciplinary (TD) approach is necessary to implement the SSF Guidelines at a local level, considering the problems and priorities in fisheries and ocean governance, with a widening of viewpoints that intersect and bring together academic disciplines, interweave scientific and community rooted knowledge, and mobilize information through campaigns and innovative educational opportunities. TBTI organizes webinars, conducts trainings, and promotes knowledge exchanges that further SSF academics, fishers, and allies alike to play active roles in raising awareness around the SSF Guidelines and efforts that lead to their implementation.

There also exist educational projects engaging rightsholders directly such as the *SSF Academy*. According to Mundus Maris, the international nonprofit behind the initiative, the SSF Academy aims to:

> "serve as a safe multi-actor platform for free and respectful exchanges, co-learning and co-production of knowledge and innovations for marine protection, the sustainable use of marine and coastal resources and sustainable and prosperous artisanal fisheries" (United Nations, 2020).

Between 2011 and 2013, the SSF Academy developed a teaching toolkit (including teachers guide, peer workbook, ruler for measuring fish, and other supporting materials) on an ecosystem approach to fisheries together with educators in Gambia and Senegal, and FAO support. In June and October 2019, the SSF Academy tested visual participatory training methods in Yoff and Hann, Senegal. These specific workshops focused on gender equity, a critical aspect of the SSF Guidelines' implementation (Chapter 8) and progress towards Sustainable Development Goal (SDG) 14: Life Below Water.

The SSF Academy reports that one exemplary participant was able to double her income within four months after participating in the workshops. She was able to earn more although structural economic constraints continued. According to a progress report on the *UN Department of Economic and Social Affairs*, the SSF Academy is focused on building local

facilitators' capacities in the academy's space in Senegal and enabling collective advocacy and participatory action-based research. The Academy is one of the strongest examples of bridging high-level call to actions and local engagement which engenders opportunities for true impact and results.

Overall, engaging local communities in the implementation of the SSF Guidelines remains focused on involving adults who fish or carry out pre- and post-harvest activities along the value chain. Reviewed sources highlight youth in the context of implementation in a few cases.

In FAO report *Towards the implementation of the SSF Guidelines in West and Central Africa*, the background paper (Annex 6) notes the consideration of youth in 2.4.3 Development prospects for small-scale fisheries in Côte d'Ivoire.

> "In order to reduce the strong dependence on fishery product imports, the public authorities have focused attention on the development of small-scale fisheries and aquaculture. The objective is also to generate income in rural communities by attracting youth through the considerable fishing potential offered by over a hundred fish families of several species" (Franz, Smith and Westlund, 2019, p. 57).

Here youth are described in the context of developing the West African country's rural economies through the development of the small-scale fishing families' potential which may shift the nation's dependency on imported fisheries products.

In FAO report *Towards the implementation of the SSF Guidelines in the Southeast Asia region*, Working Group 2 examining Social development, employment and decent work (Chapter 6) and Gender equality (Chapter 8) and Disaster risks and climate change (Chapter 9), made reference to youth (Annex 5). Members of the working group were mostly from academia or research institutions in Southeast Asia. The group identified the issue of "limited or lack of access to education for all" and identified their vision for "informed and educated coastal communities" (Franz *et al.*, 2016, p. 69). Good practices or ongoing initiatives identified included the "development of context-specific curriculum for primary/secondary school for coastal communities as an example from Thailand" (Franz *et al.*, 2016, p. 69). At the national level, one proposed action put forward by the working group was to "develop specific curricula based on SSF needs, in consultation with SSF stakeholders" (Franz *et al.*, 2016, p. 69). Working Group 2 members highlight the importance of place-based education with a focus on addressing specific needs in fish-dependent communities so that youth may gain practical skills necessary to address these growing challenges (Franz *et al.*, 2016).

The UN declared 2022 as the International Year of Artisanal Fisheries and Aquaculture. Since the beginning of the year, small-scale fisheries organizations from across the world have worked closely to develop a Call to Action towards their governments. Among the five key demands for governments is an ultimate urge to "build resilient communities to face climate

change and offer prospects to youth" (Philippe, 2022). Climate change is viewed as the biggest challenge to sustainable development around the world, and fishing cooperatives and associations end their five demands with a clear ask for governments to support their community's resiliency to confront climate change but also, by creating opportunities for their young people. Fishing organizations note that a warming planet and disenfranchised youth significantly undermine their communities' sustainable futures (Philippe, 2022).

In FAO evaluation of the project "Enhancing the contribution of small-scale fisheries to food security and sustainable livelihoods through better policies, strategies and initiatives," authors conclude that, "Youth and private sector actors have not received enough attention" in implementation of the SSF Guidelines (FAO, 2021). Authors recommend that national level interventions should place a greater emphasis on youth, among other target groups including indigenous peoples. The authors attribute this lack of consideration in part because youth are mentioned only twice in the SSF Guidelines. Paragraph 6.14 states that national governments should ensure young people have access to quality education that meets the needs of the fishing communities and "facilitate gainful and decent employment of youth, respecting their career choices and providing equal opportunities for all boys and girls and young men and women" (FAO, 2015, p. 9). Authors also note that often implementation measures target involving more senior community members and stakeholders. Youth are considered still "more peripheric dimensions" in fisheries governance and management, and therefore, a mindset shift is needed to see the roles youth already play in their small-scale fishing communities and build upon their strengths.

In FAO publication, *Involving the People: Democratizing the implementation and monitoring of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*, the author notes the importance of children and youth engagement in achieving comprehensive community involvement in monitoring and evaluation of guideline implementation at the local level (Kurien, 2022). This is especially true when considering the sustainability of participatory processes. This report shares examples of ways youth can contribute their perspectives from audiovisual narratives (such as "PhotoVoice" documentation of fishing gears and operations), community mapping exercises, theatrical skits, action research, and including SSF issues within school curricula. Educational outreach is a vital component of a dynamic and futuristic view of monitoring in a small-scale fishing village. While few countries have established "fishery schools," curricula may focus on industrial fishing rather than attuned to the needs and experiences of young people's fish-dependent villages. These schools may also recruit young people from inland villages for large-scale fishing operations (Kurien, 2022).

Furthermore, the report proposes participatory ways in which young people can become involved in monitoring and evaluating the implementation of the SSF Guidelines. These include focus group semi-formal discussions, "fishbowl" dialogues involving an inner circle of youth conversing while an outer group observes, and costs and earnings studies. Cost and earning studies seek to realize fishing or post-harvest activities' economic operations from

an individual, household, and societal perspective (Kurien, 2022). As youth are often observing their family and communal dynamics whilst participating in society, their participation in this kind of monitoring could generate nuanced knowledge. The report notes that monitoring costs and earning can present challenges as money exchanged is often a sensitive subject for participants to report about. Therefore, involving youth in sharing their observations, if done securely, could be more palatable by community members. It is critical for educators to also take part in such processes and for feedback structures for community elders to connect with young people (Kurien, 2022).

Case study contributors also note the well-being of youth as possible indicators of implementing the guidelines at the local level. These include evidence of youth completing elementary and secondary education or youth interested in innovative fishing at their local level with entrepreneurial initiatives.

There must be a focus on youth's involvement in co-creating the future of their small-scale fisheries regarding management and conservation, applying their increasing literacy levels and educational aspirations to participate in the sustainable development of their fishery, bringing fresh perspectives, novel ideas for entrepreneurship, and advocacy actions to their local context which could support local uptake of the SSF Guidelines.

3.1 Co-Management for Sustainable Fisheries with Youth Involvement

The SSF Guidelines recommend co-management as a best practice for small-scale fisheries management (FAO, 2015). For centuries, local communities customarily managed their aquatic resource systems. However, often a legitimate acknowledgement of these historic tenure systems or arrangements is lacking, which leads to a constant breakdown of customary laws, norms, and practices attributed to social, economic, environmental, political and infrastructure transformations. The result is a significant breach in good governance and effective fisheries management (Courtney and Jhaveri, 2017). Moreover, today, small-scale fishing communities are affected by a myriad of external factors nonexistent when traditional management systems were forming.

These influencing circumstances raise unanticipated management challenges that undermine traditional arrangements. Given that tradition is inherently associated with a specific notion over a period of time, customary management's resilience depends on the adaptation of tradition without a loss of the legitimacy rooted in its identity (Bennett, 2012). Co-management is one solution considered as a participatory management model that addresses changes over time and design gaps, and encourages the holistic sustainability of small-scale fisheries (Cinner, 2005; Bennett, 2012; Courtney and Jhaveri, 2017; d'Armengol Catà *et al*., 2018).

Kurien in *APFIC webinar 2021: Characteristics and performance of co management in Asia* describes co-management of SSF as a multi-faceted dance between actors within and around fisheries

and ecosystems to support the sustainable harvesting of aquatic resources. Co-management is “an evolving, dynamic process and a cooperative, multi-partner initiative, with mutual rights and obligations, to manage and steward different realms of a fishery – pre-harvesting, harvesting, post-harvesting and marketing” (Kurien, APFIC webinar 2021: Characteristics and performance of co management in Asia, 2021).

This focus on co-management has risen as a response to meet the anthropogenic stressors, threats, and challenges fisheries face in an industrializing planet and changing climate (FAO, 2016). d’Armengol Catà *et al*., (2018) suggests that for the best possible outcomes, co-management should be socially diverse, involving a symphony of different actors who know their roles and plans. Moreover, implementing adaptive management practices contributes to more positive outputs. This approach entails incorporating the views of diverse actors with recognized agency within the fishery. Youth as an intersectional stakeholder group, are missing from this conversation but must be considered within the adaptive management plans.

Closely related to co-management is tenure over natural resources. As Courtney and Jhaveri (2017) explain, tenure “refers to the social relations, institutions, and rules that govern people's access to and use of land, water, and natural resources” (Courtney and Jhaveri, 2017, p. ii) Reviewed sources posit that securing tenure and strengthening SSF governance can achieve multifaceted sustainable development targets including gender equity, poverty eradication, food security, biodiversity conservation, and climate resiliency.

Cinner (2005) explores customary marine tenure (CMT) as the legal and socio-cultural foundation by which small-scale fishing communities in the Western Pacific have traditionally employed myriad resource management techniques which serve to limit marine resource use to support the sustainability of their sustainable futures. These measures include temporal reef closures, gear restrictions, entry limitations, and the protection of spawning aggregations. There is a revitalization of these traditional fisheries resource management approaches by community, State, and nonprofit partners given the participatory nature of traditional fisheries resource management approaches and their perceived potential for addressing coupled conservation and community objectives. The doubt is whether these techniques can adapt with the ongoing social and economic changes impacting fish-dependent communities across the world (Cinner, 2005).

Several articles note the difficulty for youth groups in accessing their rights in tenure or resource management decision making. This contributes to their lack of involvement in small-scale fisheries and a drive towards other socioeconomic development activities (urban, aquaculture, technology). The participation of young people in traditional marine tenure and fisheries management systems could support the resilience of these approaches. However, for this to happen, youth would need to remain in their communities. Young people are the local rightsholders with the highest mobility, often relocating from rural to urban areas. As suggested by Kurien (2022) and Bennett (2012), traditional management systems

would also need to allow space for youth to evolve the system with the times, and make staying in their localities an attractive option.

Co-management strategies have led to increased socioeconomic benefits for fish-dependent communities in the context of both terrestrial and marine protected areas. Oldekop *et al*., (2016) found that those protected areas with reported socioeconomic gains were more likely to record positive conservation outcomes, and these socioeconomic benefits were more likely to appear when protected areas were managed to foster sustainable resource use rather than enforce rigid protection of aquatic resources. Protected areas met conservation goals more consistently and often when the area simultaneously engaged local people in governance, enhanced cultural benefits, and reduced livelihood costs. Furthermore, Oldekop *et al*. (2016) found that protected areas co-managed by both local rightsholders and conservation allies were more commonly linked with delivering greater benefits to small-scale fishing villages than solely community or state-managed protected areas. Findings suggest investment in local institutional capacity building and project design are vital for effective and equitable community-based natural resource management projects, however communities co-managing protected areas collaborating with social or environmental entities are disposed to gain from increased institutional support that promote secure tenure rights and participatory decision-making processes while also encourages economic benefits and just distribution of these benefits (Oldekop *et al*., 2016).

d'Armengol Catà *et al*., (2018) note that by cultivating stronger tenure systems and local decision-making processes, there is a more equitable distribution and an increase of economic returns. As youth are hardly mentioned, the question becomes, how can youth directly benefit from or be involved in ensuring successful co-management schemes? (d'Armengol Catà *et al*., 2018)

The Centre for Resource Management and Environmental Studies (CERMES) at the University of the West Indies created a series called *The Future We Want - Voice of Fisherfolk* during the International Year of Artisanal Fisheries and Aquaculture 2022 which provided a platform for small-scale fisheries actors to share their perspectives.

One young artisanal fisher offered his perspective on the future he envisioned,

> "I would like to see proper infrastructure here, proper fisheries management ensuring sustainable futures, I would like to see a school for fisheries, fishers selling directly to customers here and overseas, that there by more equity in the value chain and fisheries integrated in other sectors for example sports, tourism" (Joseph, 2022).

In his response, Joseph (2022) places an emphasis on education, responsible resource management, equitable value chains, but also offers an entrepreneurial approach by associating sports and tourism with sustainable small-scale fisheries. Young people may

present novel ways that their villages or districts could adapt to social and environmental changes impact fish-dependent communities across the planet.

In relationship to Social Development in SSFs, Courtney and Jhaveri (2017) refer to youth's secure access to education as a part of effective marine tenure systems, referencing Paragraph 6.14 of the SSF Guidelines:

> "Providing and enabling access to schools and education facilities that meet the needs of small-scale fishing communities and that facilitate gainful and decent employment of youth, respecting their career choices, and providing equal opportunities for all boys and girls and young men and women" (Courtney and Jhaveri, 2017, p. 46)

The authors also acknowledge the importance of young people's holistic health and wellbeing to ensure they can play active roles in their own futures and those of their communities (Courtney and Jhaveri, 2017).

Courtney and Jhaveri (2017) contribute eight principles for natural resource management that must be considered when designing for co-management. Questions for how youth can be involved were added to each:

Principle	Questions for Consideration
Boundaries at user and resource level:	● How can youth and the wider community understand this dynamic as a relationship between human and nonhuman in a shared environment? ● How can youth secure meaningful data concerning rules and regulations within their fishery?
Congruence with local conditions:	● How can young learners support congruence with cultural and social conditions? ● Students could produce nuanced data needed to consider local communities' vision and problems.
Appropriation and provision:	● What are the rules? ● Who made the rules? ● How do the rules work? ● Asking these questions is essential for youth to "see" the invisible ways the natural environment around them is "managed" and how it can be improved.

Collective choice arrangement:	• Given the complexity and currently lack of mechanisms to incorporate youth into this decision-making platform, in what ways can young people contribute their voices to the discussion?
Monitoring:	• How can youth support monitoring?
Sanctions:	• How can youth best understand sanctions?
Conflict resolution mechanisms:	• Rarely discussed in the literature, but how can fisheries-related education enable youth role in these mechanisms?
Recognition of their resources and rights:	• The SSF Guidelines provide an opportunity to explore their human rights through its framework. How can this be done effectively?

Adapted from Courtney and Jhaveri (2017)

Beyond the specific design aspects of community-based marine tenure systems, Courtney and Jhaveri (2017) identify potential drivers that can threaten the viability of these institutions. These drivers include ocean acidification as a result of global warming, subsidies that cause overcapacity in large-scale fisheries, and with a particular attention to young people, authors mention the loss of youth's interest in traditional practices as a governance issue. Therefore, it is critical that young learners are engaged in conversations with elders about the future of their communities as social-ecological systems, and where tradition and entrepreneurship can mix in an effort towards resilience-building in a warming planet and industrializing society.

There are historical co-management systems that have incorporated space for youth to be involved in management, or at minimum, to observe and learn from community leaders. Authors Tilley *et al.* (2019) in their paper, *Evaluating the Fit of Co-management for Small-Scale Fisheries Governance in Timor-Leste* describe Sucos as community-based institutions that are founded upon historical and cultural connections, linked to traditional or familiar relationships. Timor-Leste's over 440 *Sucos* play a fundamental role in local villages, providing community cohesion and conflict resolution mechanisms (especially among youth groups), advising the allocation of leadership roles, facilitating decision-making processes, and guiding the use of shared natural resources (Tilley *et al.*, 2019).

In 2004, Timor-Leste passed a formal provision for the election of Suco council bodies. The measure formally incorporated existing customary practices into state-based institutions. In 2016, a second law refined the composition of the Suco council to legally affirm their authority. According to Article 10 of Law n.o9/2016, each Suco council is composed by the Suco Chief, smaller hamlet Chiefs in the Suco (village), a female delegate from each hamlet, a male delegate from each Suco's aldeias (hamlets), a female youth representative from the

Suco; a male youth representative from the Suco (Tilley *et al*., 2019). While the Sucos encourage the participation of young people through a formalized quota system, Tilley *et al*., (2019) also note that in the case of Timor-Leste, "the increasing education and westernization of youth in Timor-Leste may threaten the effectiveness of these spiritual sanctions in controlling behaviors in the longer term" (Tilley *et al*., 2019, p. 12). Co-management schemes need horizontal participatory processes and decision making equal to all actors, including youth's voices. All rightsholders and stakeholders participating in the co-management scheme need to play their role actively. Failure of the system implementation starts when stakeholders fail to comply or are unwilling to participate.

A case study from India further illuminates challenges that make youth's involvement in co-management difficult. Salagrama (2015) describes the 1990s as a decade in which the Indian government's liberalization policies spotlighted the coastlines as unused development zones, which overshadowed any effort to formalize legitimate tenure rights of the fishing communities. Moreover, while local fishing economies decreased in value, levels of literacy and new opportunities subsequently increased, leading to a significant diversification of livelihoods within and beyond fisheries. These factors contributed to a degenerating hold of the customary governance systems by younger generations. Educated youth in fishing villages tend to disdain customary rules, viewing traditional principles and village law as backwards, and those with newfound affluence disregard them with impunity. Salagrama (2015) notes that where new industries establish themselves within formerly unremarked coastal areas, issues arise as youth enchanted by new opportunities and newly fixed elites dissent against village elders who have borne witness to monumental changes in their lifetimes, and have the wisdom to identify which changes might lead to further losses. In such a scenario, enforcement by the collective at the local level, one of the determining factors of customary rule, is no longer viable (Salagrama, 2015).

Therefore, Salagrama argues that educated youth - a growing, progressive group with novel ideas - should be valued as a vital resource in community development and integrated into fisheries management rather than be left on the fringes. Youth and elders, often at odds, could collaborate by innovating customary rule in the context of a changing climate and industrializing planet in an effort to protect their fisheries resources while also engendering new opportunities to keep the next generation of local leaders local.

Kurien (2017) describes youth's involvement in the co-creation of a new co-management initiative in Aceh Province of Indonesia in the wake of the 2004 Asian tsunami. A collaborative effort of FAO and the American Red Cross (ARC), the initiative was part of a development assistance program. The tsunami left a convoluted social, political, and physical land- and seascape in its wake, and therefore, these new entities were envisioned as an endeavor to build back better in the post-disaster context. Unlike conventional fisher organizations such as associations, cooperatives, or unions established as management units concerning the use of aquatic assets, the organizational entities Kurien (2017) examines were grounded on co-management principles of fishery resources for the

sustainable livelihoods by myriad rightsholders including youth from the coastal communities.

Young men and women from the four western districts of Aceh most affected by the tsunami assembled together with fishers and government officials. Co-management negotiations initially followed a strategy consisting of three stages: (1) awareness creation, (2) capacity building and (3) field action over a three year period (2007-2010). This three-fold strategy served as the grounds for fostering collective action to develop the new organizational innovation rooted upon co-management. Kurien (2017) describes the primary field activities of co-management were rejuvenation and conservation of aquatic resources destroyed by the tsunami together with livelihood restoration of seaside villages.

During the first stage of the strategy, following the dissemination of awareness creation products in the coastal areas presenting an understanding and relevance of co-management, the program issued a training course for young men and women of the villages across the four districts. The program involved community socio-political leaders in defining the selection criteria for youth participation ensuring collective support from elders and a “moral obligation” for the youth to serve the community upon completing the training (Kurien, 2017).

The second stage centered on capacity building. The three-weeklong training course focused on developing skills in community organizing and socio-technical aspects of fisheries co-management through a participatory pedagogy, youth action processes, and composed of knowledge inputs. By the end of the training, 131 young men and 33 women enthusiastically returned to their villages committed to community action for fisheries co-management, playing the role of “creative irritants” or “community motivators” forming the new co-management organizational bodies (Kurien, 2017).

The strategy’s third and final stage focused on putting the awareness raised on co-management principles and capacity building for community organizing into action at the local level. Poignantly, it was the collective of young people or newly trained, self-determined “community motivators” who took the lead role in organizing the informally constituted fisheries co-management fisheries forums in each of the four districts. Driven by youth, the forum became a medium for cultivating interest and even involving local authorities in co-management of aquatic resources, and resulted in the initiation of five fishery co-management entities spread across Aceh’s west coast of Aceh in less than two years.

Kurien’s case study (2017) provides insights into what may result when initiatives directly engage youth in building their capacities as potential agents in co-management. The outcomes may be especially generative when utilizing a participatory pedagogy, viewing young people through a positive youth development lens, and providing connections through a social network with established community leaders.

4. Conclusion

This in depth review of literature relevant to the SSF Curriculum revealed that areas of small-scale fisheries and aquaculture remain understudied as they refer to youth engagement. While youth are rarely mentioned in the reports from FAO's consultations on the implementation of the SSF Guidelines, fisheries stakeholders identify the immense potential created by involving youth in sustainable fisheries. However, as the literature reveled, there is a trend of declining youth involvement and active participation in SSF. Many factors contribute to this including: fishing uncertainty; increasing climate variability; accessing rights to tenure, resource management, and decision making; and access to educational and employment opportunities.

For tenure rights and responsible resource management systems to be secure, equitable, effective, and sustainable; youth must be brought into the forefront. Youth engagement is vital to the resilience of a SSF community. Therefore, in order to successfully manage social-ecological resources, co-management must include raising awareness and building capacity with the youngest members of the community through educational opportunities and participation in decision-making processes. Outward migration among young people is one of the greatest risks SSF communities face and one that often goes unremarked and understudied.

Responsible resource management and tenure in protected areas that report socioeconomic benefits often had positive conservation outcomes and included sustainable resource use, rather than those with strict biological goals. Investing in place-based quality rural education is one critical goal that must be included within a management system. Successful tenure and responsible resource management were found to originate from collaboration with community members, institutions, nonprofits, and other social-ecological minded groups. Collaborative entities that place quality education and positive youth development at the forefront of their work demonstrated greater benefits for SSF communities overall.

This literature review evidenced a number of gaps in academic knowledge related to youth in SSF communities, rural education, and youth as community stakeholders, as well as identified opportunities and challenges specific to youth education in rural and SSF communities. Most notable in the context of curriculum development were the challenges of high drop-out rates and low connectivity between classroom learning and traditional, practical knowledge. One of the curriculum's objectives, as developed from this literature review, is to bridge the gap between the aspirations and expectations of young people for becoming effective agents of change and sustainability.

The overall goal of designing a comprehensive curriculum to guide teachers and students in the exploration of their aquatic social-ecological system is to develop in learners a deeper, more nuanced appreciation of their built-natural environments; of the place where they are living; of its social history; of the biodiversity that exists there; and of how people have responded and continue to respond to their natural and social environments.

From this foundation, this curriculum works to transcend traditional educational pedagogical approaches and drive towards innovative educational methods that reinforce youth's identity and capabilities within the SSF community. Open pathways towards innovation are present with youth, as this demographic is often more receptive than older generations to learning about and becoming involved in new approaches and technologies related to resource conservation in SSF communities and interconnected social-ecological systems. Therefore, this curriculum must consider intrinsically the needs of young learners and their fish-dependent communities:

- Address early drop-out rates among students who leave to seek paid work or feel they have "had enough school" by enabling students to see the value in their education as a pathway towards financial and personal agency.
- Establish connections between academic learning and real-world challenges and opportunities through place-based education. This includes ensuring that in-school education aligns with the real-life complexities experienced by students through an "integrated, interdisciplinary, and frequently project-based approach where all learners are accountable and challenged." (Te Kete Ipurangi, 2022)
- Offer young learners opportunities to engage with decision-makers and in managerial processes, exploring possible avenues to increase young people's participation in the overall sustainability of their local fishery.
- Increase awareness of the SSF Guidelines among young people, local educators, and fishing families while involving youth in the monitoring and implementation of the SSF Guidelines.
- Evoke curiosity and enable students to generate relevant data about their SSF, using the local community and environment as a starting point to share concepts mirrored in the SSF Guidelines.

In addition, an effective curriculum design and implementation depends entirely on local conditions and priorities. For example, Latin American communities associate potential success to: systematic collaboration and knowledge sharing between youth and public policies or institutional programs; the incorporation of spaces for reflection, creativity, and play; and the ability to take a realistic approach to the empowerment of SSF youth within their sociocultural reality. Likewise, for African local communities long term commitments are key, as well as provision of scholarships for interested SSF youth to support long-term studies in aquatic fields could help to increase the level of expertise within the community. The curriculum must be adaptable and responsive to the gap between the aspirations and expectations of young people to become effective agents of change and sustainability in their SSF communities.

Through a comprehensive review of the existing literature focused on youth engagement in SSF communities, the CDWG identified various challenges and opportunities that served as an important base for the development of this curriculum. There is a need for further

monitoring and evaluation of this understudied demographic and follow up research on the impacts of implementing a curriculum that utilizes the various environmental pedagogies outlined in this literature review. Overall this literature review provided valuable insight into the state of education in SSfs, rural education and environmental pedagogies, and the community level implementation of the SSF Guidelines.

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