

**DIRECT NATURE EXPERIENCES ON
BIODIVERSITY KNOWLEDGE, ATTITUDES AND
CONSERVATION WILLINGNESS AMONG
MALDIVIAN CHILDREN**

FARUHANA ABDULLA

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**DIRECT NATURE EXPERIENCES ON
BIODIVERSITY KNOWLEDGE, ATTITUDES AND
CONSERVATION WILLINGNESS AMONG
MALDIVIAN CHILDREN**

by

FARUHANA ABDULLA

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LIST OF ABBREVIATIONS

CBD	Conservation of Biological Diversity
DNE	Direct Nature Experiences
IE	Island Environment
MOE	Ministry of Education
MOEE	Ministry of Energy and Environment
NCF	National Curriculum Framework
NE	Nature Experiences
NES	Nature Experiences with Species
NIE	National Institute of Education
SAO	Seen Alive Only
VNE	Variety of Nature Experiences

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**PENGALAMAN LANGSUNG DENGAN ALAM SEMUA JADI TERHADAP
PENGETAHUAN BIODIVERSITI, SIKAP DAN KESEDIAAN
PEMULIHARAAN DALAM KALANGAN KANAK-KANAK MALDIVES**

ABSTRAK

Banyak sejarah menunjukkan bahawa pengalaman secara langsung alam semulajadi (DNE) dalam kehidupan seharian kanak-kanak membentuk asas amalan kelestarian di Maldives. Walaupun kanak-kanak Maldives kontemporari mungkin merasai kehilangan DNE, tahap masalah ini atau akibatnya masih tidak diketahui. Tujuan utama kajian ini adalah untuk mewujudkan dan memahami trend semasa dalam DNE dan pengaruhnya terhadap pengetahuan biodiversiti (BK), sikap terhadap biodiversiti (AA), dan kesediaan pemuliharaan (CW) dalam kalangan kanak-kanak sekolah berumur 11-12 tahun di Maldives dalam persekitaran pulau yang pelbagai. Ia juga bertujuan untuk meneroka dan memahami faktor kontekstual yang mempengaruhi pengalaman ini. Kajian ini menggunakan reka bentuk kaedah campuran tertanam yang melibatkan kaedah tinjauan dalam talian (n=429) dan temu bual kumpulan berfokus (n=34) dari sekolah-sekolah di tujuh buah pulau. Data kuantitatif dianalisis menggunakan statistik deskriptif dan inferensi. Keputusan menunjukkan tahap pengalaman kekerapan DNE (EF) dan Seen-Alive-Only (SAO) yang lebih tinggi untuk kebanyakan kanak-kanak di luar kawasan Male', manakala kepelbagaian pengalaman (VNE) adalah serupa dalam semua IE. Beberapa spesies tidak pernah dilihat oleh ramai kanak-kanak tanpa mengira IE. Kebanyakan kanak-kanak menunjukkan tahap BK yang rendah dan tahap AA dan CW yang sederhana atau rendah. Ujian ANOVA sehalu menunjukkan bahawa hanya BK dan AA meningkat dengan ketara dengan peningkatan EF. VNE dan SAO menunjukkan korelasi positif yang signifikan dengan BK dan AA, tetapi hanya VNE yang berkorelasi secara signifikan dengan CW. Analisis

pengantaraan dua siri mengesahkan laluan jujukan ramalan yang kurang dilaporkan dari DNE ke CW melalui BK dan AA. Tambahan pula, DNEs (EF dan jenis) memberikan kesan langsung yang positif pada BK dan AA. Walau bagaimanapun, kesannya terhadap CW adalah tidak langsung dan bukannya langsung. Analisis tematik data kualitatif menunjukkan bahawa pengalaman semula jadi kanak-kanak dipengaruhi oleh keutamaan, kekangan, peluang dan kebebasan, yang mana faktor yang paling berpengaruh ialah peluang. Oleh itu, kanak-kanak mesti diberikan DNE yang bermakna secara kontekstual yang merangsang pembelajaran pengalaman transformatif untuk membangunkan sikap dan tingkah laku positif yang melindungi alam semula jadi. Setiap sekolah mesti memainkan peranan proaktif dalam memudahkan pengalaman ini. Penemuan ini menyumbang kepada pemahaman bagaimana DNE yang diterima setiap hari mempengaruhi hasil melalui lensa pelbagai teori. Kekurangan kajian tentang DNE yang diterima setiap hari dalam kalangan kanak-kanak Maldives bertindak sebagai satu langkah ke arah kejayaan pendidikan untuk pembangunan lestari (ESD) dan pemuliharaan dan kelestarian biodiversiti untuk jangka masa Panjang.

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CHILDREN**

ABSTRACT

Historically abundant DNEs in children's everyday lives formed the roots of sustainable practices in the Maldives. Although contemporary Maldivian children may be subject to a loss of DNEs, the extent of this problem or its consequences remain largely unknown. This study aimed primarily to establish and understand current trends in DNEs and their influences on biodiversity knowledge (BK), attitudes towards biodiversity (AA), and conservation willingness (CW) among 11–12-year-old school children in the Maldives in different island environments. It also aimed to explore and understand the contextual factors that influence these experiences. This study employed an embedded mixed-method design composed of an online survey (n=429) and focus group interviews (n=34) from schools in seven islands. The quantitative data were analyzed using descriptive and inferential statistics. Results demonstrated higher DNE frequentness (EF) and Seen-Alive-Only (SAO) experience levels for most children outside the Male' area, while the variety of experiences (VNEs) was similar in all IEs. Several species were not seen by many children regardless of IE. Most children demonstrated a low level of BK and moderate or low levels of AA and CW. One-way ANOVA tests showed that only BK and AA increased significantly with increased EF. VNE and SAO showed significant positive correlations with BK and AA, but only VNE is significantly correlated with CW. A two-serial mediation analysis confirmed an underreported predictive sequential pathway from DNE to CW through BK and AA. Furthermore, DNEs (EF and types) exert positive direct effects on BK and

AA. However, their effects on CW are indirect rather than direct. A thematic analysis of the qualitative data revealed that children's nature experiences are influenced by preferences, constraints, opportunities, and freedom, of which the most influential factor was opportunities. Hence, children must be afforded contextually meaningful DNEs that stimulate transformative experiential learning for developing nature-protective positive attitudes and behaviors. Schools must play a proactive role in facilitating these experiences. The findings contribute to understanding how everyday DNEs influence outcomes through the lenses of multiple theories. The lack of studies on everyday DNEs among Maldivian children as a step towards successful ESD and long-term biodiversity conservation and sustainability increases the significance of this study.

CHAPTER 1

INTRODUCTION

1.1 Introduction

A perceived loss of direct nature experiences (DNEs) among children and its consequences are a rising scholarly concern. Global studies often associate this phenomenon with unfavorable circumstances surrounding the daily lives of children living in urbanized settings dominated by contemporary lifestyles (Charles et al., 2018; Imai et al., 2018; Novotný et al., 2021; Soga et al., 2020; Zhang et al., 2014). However, DNEs are declining not just among citizens of many urban cities but also in less developed and rural areas. Subsequently, humans are becoming disconnected from nature, with far-reaching negative effects (Charles et al., 2018; Soga & Gaston, 2016). With approximately two-thirds of the world's population predicted to become urban dwellers by 2050 (United Nations Department of Economic and Social Affairs, Population Division, 2019), a decline in DNEs, as well as its consequences, can be substantial for tiny, vulnerable islands like the Maldives.

Evidently, over the years, efforts to understand the impacts of childhood nature experiences have broadened to span many disciplines, often driven by their underlying health and psychological benefits (e.g., Bell et al., 2019; Chawla, 2015, 2020; Holland et al., 2021; Sandifer et al., 2015; Soga et al., 2021). However, there is a growing interest in understanding the effects of children's nature experiences on biodiversity conservation (e.g., Almeida et al., 2018; Freeman et al., 2018; Soga et al., 2016; R. L. White et al., 2018; Zhang et al., 2014) and sustainable development (SD) (Selby & Kagawa, 2018b; Spiteri, 2020). One reason for this interest is the reciprocity of human-nature relationships — while human survival depends on nature, humans have a responsibility to sustain natural resources. Childhood nature experiences lay the

foundations for this relationship (T. H. Beery & Lekies, 2021; Louv, 2005). Hence, sustainability-targeted plans must address the widening disconnect between humans and nature as they indirectly propel biodiversity loss (Charles et al., 2018; Convention on Biological Diversity [CBD], 2018a).

Human-nature relationships underpin several of the Sustainable Development Goals (SDGs) of *Transforming Our World: The 2030 Agenda for Sustainable Development* (Charles et al., 2018; Ives et al., 2018; Scharlemann et al., 2020). Importantly, the success of the *2030 Agenda* also depends heavily on transforming learners in ways that promote a sustainable future through education (Leicht et al., 2018). Thus, in the context of this study, SDG 4 (on inclusive and quality education for all and the promotion of lifelong learning), particularly Target 4.7, advocating education for sustainable development (ESD) as a roadmap to fulfill the interconnected SDGs (Cebrián et al., 2020; Shulla et al., 2020; United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2020), is especially relevant. ESD embraces action-oriented, novel, and transformative pedagogical approaches to education aimed at empowering learners with competencies necessary for making informed decisions conducive to lifelong sustainable behaviors (UNESCO, 2020a). Hence, many countries are adopting this approach in their education systems (Cebrián et al., 2020; Laurie et al., 2016; UNESCO, 2020a).

In compliance with commitments to realize a sustainable future for all (Ministry of Environment and Energy [MOEE], 2015b), biodiversity conservation and sustainable practices are integrated into the Maldives National Curriculum Framework (NCF). Of direct relevance to this study is its key competency, *Using Sustainable Practices*, which seeks “to raise awareness to engage in sustainable practices and learn conservation for the future” (National Institute of Education [NIE], 2014, p. 19). It is

envisaged that this key competency will instill in learners the knowledge, skills, and values that will enable them to care for their environment and motivate them to become future environmental stewards. To this end, experiential learning and learner-centered approaches are especially encouraged. However, for ESD to be successful, it is imperative to rectify the “de-natured conditions” in which it is currently practiced by increasing children's nature interactions (Selby, 2017, p. 24) — a noted issue in the context of the NCF of the Maldives (Kagawa, 2022). Furthermore, for effective ESD, it is necessary to connect the lifelong learning and education stipulated in SDG 4 to life on earth (Charles et al., 2018). Notably, these learning, skills, and values are rooted in informal, routine nature experiences rather than formal education and form the basis of traditional sustainable lifestyles in the Maldives (M. Mohamed, 2012). Other literature also supports that DNEs in childhood influence many conservation-related variables, including biodiversity knowledge (Almeida et al., 2018; Freeman et al., 2018; R. L. White et al., 2018), attitudes towards and willingness to conserve biodiversity (Soga et al., 2016; Soga & Gaston, 2016; R. L. White et al., 2018; Zhang et al., 2014). Hence, the calls to increase DNEs and experiential learning to strengthen nature connections since childhood (Charles et al., 2018; CBD, 2018a) is particularly relevant to the current study.

1.2 Background

Direct nature experiences (DNEs) in childhood are pivotal to establishing sustainable relationships with nature (T. Beery & Jørgensen, 2018; Imai et al., 2018; Kellert, 2002, 2005; Kellert et al., 2017; M. Mohamed, 2012; Wells & Lekies, 2006). Nevertheless, specific age-dependent responses to experiences remain contentious (T. Braun & Dierkes, 2017; Otto et al., 2019). Generally, middle childhood (6-12 years) is the most responsive to nature experiences because, at this age, children interact with

nature in many ways and levels that nurture positive effects (Blanchet-Cohen, 2008; T. Braun & Dierkes, 2017; Little & Derr, 2018). Recent studies show that positive responses to nature experiences increase from seven years and peak around ten years (Otto et al., 2019). Notwithstanding uncertainties, nature experiences before 11-12 years are often correlated with life-long effects that may influence future biodiversity conservation (Jensen & Olsen, 2019; Lieflander et al., 2013; Wells & Lekies, 2006). Such effects may sprout from baseline levels of perceptions of nature established during childhood (Papworth et al., 2009; Soga & Gaston, 2018). Nonetheless, scholars caution that contexts surrounding experiences must be discerned as they underpin motivational bases for future involvement with nature (Adams & Savahl, 2015; Chawla, 2009, 2020; Collado et al., 2013; Sugiyama et al., 2021).

Children's nature experiences may be broadly categorized as those involving physical contact and those that do not. Beyond these categories, conceptions become inconsistent. Indeed, the imprecise conceptualization of *nature* and *nature experiences* (NEs) among researchers is a noted challenge in research in this field (Chawla, 2020; Gaston & Soga, 2020; Longbottom & Slaughter, 2016; Rosa & Collado, 2019). Early literature defines *direct* NEs (DNEs) as spontaneous or unplanned activities involving physical contact with nature in their relatively wild states. Experiences in managed areas such as botanical gardens were termed *indirect NEs* and are often planned (Kellert, 2005). Currently, direct NEs are more often conceptualized as informal, firsthand interactions with plants and animals in one's everyday life (Longbottom & Slaughter, 2016). However, incidental contact with nature, as may occur during a walk or intentional acts like hiking, are also cited as DNEs (e.g., Keniger et al., 2013; Rosa & Collado, 2019). NEs through imagery or symbolic means with no physical contact are usually termed *vicarious* experiences (Almeida et al., 2018; Kellert, 2005; Soga et

al., 2016), but sometimes as *indirect* NEs (Keniger et al., 2013). Such ambiguities challenge the accurate interpretation of findings. Given the rise in urbanization, broader conceptualizations of nature may be more reasonable (Gaston & Soga, 2020).

Where a child lives, i.e., the local environment represents nature and opportunities to interact with nature. Hence, they often determine many dimensions of nature experiences among children (Soga, Yamanoi, et al., 2018), including frequencies, types, and contexts (Collado et al., 2015). Contexts give meaning to experiences that affect children's conceptions of nature which then influence outcomes (Adams & Savahl, 2015; Collado et al., 2015, 2016; Pam et al., 2021; Rosa & Collado, 2019). Such conceptions can also establish baselines of nature norms and require urgent examination as they can shift with changing environments and influence future actions (Papworth et al., 2009; Soga & Gaston, 2018).

Researchers represent natural surroundings by various constructs, including the *place of residence* (Collado et al., 2016; Duron-Ramos et al., 2020), *outdoor spaces* in residential areas (Gundersen et al., 2016), *country* (Almeida et al., 2018), *levels of urbanization* (Soga, Yamanoi, et al., 2018; Zhang et al., 2014) and *residential environments* (Imai et al., 2018). Imai et al. (2018) examined *residential environments* based on types of land use of local nature. Given that island characteristics such as human–nature interdependence, biodiversity, cultural and physical elements within islands are unique (Cheer et al., 2017; Vogiatzakis et al., 2017), this study adapts the concept of *residential environments* as *Island Environments* or simply *Islands*, a construct aimed to capture unique local environments in the island contexts of the Maldives. For example, Male', the capital city, is not only the most populous but is devoid of large natural green spaces. It does have human-designed parks and some native plants on roadsides and scattered spots. Some islands have rich biodiversity

spaces, while their destruction is escalating in others. These variations, and societal and situational factors, could significantly impact trends in nature experiences.

Trends or patterns in DNEs are investigated using several indicators. However, the lack of standard measures is a noted issue (Holland et al., 2021). Some studies examine the frequency of DNEs, i.e., how often children engage with nature (Almeida et al., 2018; Collado et al., 2015; Muslim et al., 2019; Soga et al., 2016; Soga, Yamanoi, et al., 2018). Others evaluate the types of DNEs, i.e., how children engage with nature (Collado et al., 2015; Larson et al., 2018; Soga et al., 2016; Soga, Yamanoi, et al., 2018). Often, these experiences are unplanned or routine interactions within children's surrounding nature. Examples range from catching butterflies, planting trees, observing pollination (Zhang et al., 2014), exploring natural habitats (Freeman et al., 2018; Hand et al., 2018) and nearby nature (Almeida et al., 2018; Cheng & Monroe, 2012; Hand et al., 2017) to spending alone time in nature (Szczytko et al., 2020). Sometimes children are purposely provided with nature experiences, such as through nature-based education programs (e.g., Albo et al., 2019; Barthel et al., 2018; Collado & Corraliza, 2015; R. L. White et al., 2018). DNEs, in their diverse contexts, often influence children's conservation-related knowledge, attitudes, and behaviors. This study focuses on the frequency (represented by frequentness) and types, i.e., the range of nature experiences in children's daily lives.

Good knowledge of biodiversity is essential for conservation (Genovart et al., 2013; Jiwa & Esa, 2015; Yli-Panula et al., 2018) and SD (Leicht et al., 2018; Yli-Panula et al., 2018). Nevertheless, there is a lack of a standard, concise definition of biodiversity (van Weelie & Boersma, 2018). Still, in the context of children's DNEs, three themes emerge from the literature: *species knowledge* (Albo et al., 2019; Cornelisse & Sagasta, 2018; Freeman et al., 2018; Gerl et al., 2021), *organisms and*

their environment (Freeman et al., 2018; Paraskeva-Hadjichambi et al., 2012; San Jose & Nelson, 2017) and *environmental knowledge* (Otto & Pensini, 2017). DNEs often enhance many of these measures, although inconsistent findings challenge ascertaining the most effective mode of NEs that boosts positive effects. For instance, some findings associate lower routine DNEs with poorer species knowledge (Almeida et al., 2018; Binoy et al., 2021; Genovart et al., 2013) but not always (Schlegel et al., 2015). Others indicate that indirect NEs, like visits to zoos and vicarious NEs through media and books, increase knowledge more than DNEs, although this knowledge is limited to exotic species rather than locally abundant wildlife (Almeida et al., 2018; Genovart et al., 2013). Meanwhile, knowledge about species can influence attitudes toward and willingness to protect biodiversity (Ballouard et al., 2012; Pam et al., 2021). Scant literature in the Maldives suggests a loss of nature knowledge, with global knowledge taking precedence in formal education over local knowledge through routine DNEs (M. Mohamed, 2012). Hence, the present study focuses on identifying local terrestrial animals and plants as indicators of biodiversity knowledge.

Attitudes typically involve a range of evaluations of an object or issue (Albarracín et al., 2005; Haddock & Maio, 2008). Attitudes towards biodiversity are commonly represented by *affective* attitudes. This dimension measures children's feelings towards nature, often as *connectedness with nature* (Barthel et al., 2018; Cheng & Monroe, 2012; Otto & Pensini, 2017; Soga et al., 2016; Soga, Gaston, et al., 2018), expressions of *biophilia* (Hand et al., 2017; Soga et al., 2016; Tomažič, 2011; Zhang et al., 2014) or *emotional affinity* towards nature (Collado et al., 2013; Schlegel et al., 2015). Other dimensions include cognitive attitudes, such as ecological beliefs (Collado et al., 2013) and behavioral attitudes (Paraskeva-Hadjichambi et al., 2012).

This study focuses on feelings towards local terrestrial plants and animals as indicators of affective attitudes towards biodiversity.

DNEs can enhance positive affective attitudes that stimulate motivation to protect nature (Soga et al., 2016; Soga, Yamanoi, et al., 2018; Yli-Panula et al., 2018). Conversely, its lack is associated with negative attitudes, including increased biophobia (Cheng & Monroe, 2012; Soga et al., 2020; Zhang et al., 2014) and diminished emotional affinity (Cheng & Monroe, 2012). Importantly, experiential learning through formal nature-based education can dispel negative attitudes (Albo et al., 2019; Lindemann-Matthies, 2005). However, informal, independent DNEs in everyday nature spaces provide the best learning environments to develop children's innate love or biophilia and protective desires toward nature (R. White & Stoecklin, 2008). Such is reflected in the deep-seated attachments, values, and sacred beliefs about natural resource management in the Maldives. However, a lack of nature interactions among children living in the capital away from their home communities, globalization, and awareness of legal rights, tarnish attitudes among youth, making them mock local rules for conservation in some islands (M. Mohamed, 2012). Still, positive affective attitudes may not materialize even with regular exposure to ample ambient nature (Almeida et al., 2018; Hand et al., 2018), while they may result from vicarious NEs (Soga et al., 2016). Notably, attitudes reflect perceptions about biodiversity that can influence conservation behaviors (Yli-Panula et al., 2018).

Willingness to conserve biodiversity (hereafter called *conservation willingness*) is a behavioral response to nature experiences. Behaviors represent observable actions or responses of individuals (Albarracín et al., 2005). Conservation willingness is sometimes represented as an *attitude* (Ferreira, 2012; Zhang et al., 2014), reflecting disparities in conceptualizations of variables among scholars. This variable is

frequently viewed from an environmental standpoint, for instance, *pro-environmental* or *ecological behavior* like conserving water (Collado et al., 2013; Collado & Corraliza, 2015) and energy and recycling (Ferreira, 2012; Otto & Pensini, 2017). The conservation willingness of biota sometimes explores *intentions* to act, such as the *intention* to feed birds (R. L. White et al., 2018). It often evaluates *willingness to protect* animals (Ballouard et al., 2011; Soga et al., 2016; Zhang et al., 2014) but rarely focuses on plants. In the present study, *conservation willingness* examines the willingness to protect local terrestrial plants and animals.

The influences of DNEs on conservation willingness are less clear-cut than on knowledge and attitudes. Although DNEs enhance conservation willingness (Ballouard et al., 2012; R. L. White et al., 2018), this effect is usually mediated by other factors such as attitudes (Duron-Ramos et al., 2020; Soga et al., 2016; Zhang et al., 2014). Like knowledge and attitudes, vicarious NEs are also positively associated with a willingness to conserve animals (Ballouard et al., 2011; Soga et al., 2016). Nevertheless, vicarious NEs can be problematic because negative mis-associations make children prioritize exotic species over native wildlife for conservation (Ballouard et al., 2011). They also indicate a disconnection with nature heightened by greater vicarious experiences (Truong & Clayton, 2020). Literature on conservation willingness in Maldivian children is scarce. However, disturbing abusive behaviors towards local marine life are observed among some youth who return to their native islands after living in the capital (M. Mohamed, 2012; M. Mohamed et al., 2019). In contrast, positive behaviors are demonstrated by those who live on some islands (Jaufar, 2021). Hence, differences based on resident IEs are implicated. Like attitudes, such behaviors stem from a lack of nature interactions and the insufficient emphasis on local environments in texts and schooling.

DNEs among children are influenced by many factors, sometimes classified as opportunities and orientation. Their relative strengths cannot be generalized due to discrepant findings. Opportunities represent possibilities to engage with nature in terms of time and space (Soga, Yamanoi, et al., 2018) and are often impeded by barriers that manifest with urbanization (Kai et al., 2014; Soga & Gaston, 2016; R. L. White et al., 2018; Zhang et al., 2014). Indeed, an inverse relationship between the frequency of NEs and urbanization has been demonstrated (Zhang et al., 2014) and supported (Almeida et al., 2018; Muslim et al., 2019; Mustapa et al., 2018). Orientations involve connections and feelings, i.e., attitudes towards nature (Soga et al., 2016) that may dictate the use of accessible opportunities (Kellert et al., 2017; Larson et al., 2018; Soga, Yamanoi, et al., 2018; Soga & Gaston, 2016). Hence, the mere provision of opportunities through an increased abundance of or proximity to nature may be insufficient to motivate children to explore nature (Almeida et al., 2018; Freeman et al., 2018; Gundersen et al., 2016; Soga, Yamanoi, et al., 2018). Some studies clearly link a loss of orientation with more luring alternatives, especially sedentary or digitally mediated pastimes (Ballouard et al., 2011; Larson et al., 2018); others do not (Soga, Yamanoi, et al., 2018). Meanwhile, negative associations like danger and crime are powerful demotivators for nature-seeking behaviors (Adams & Savahl, 2015). Thus, contextual differences in NEs are indicated. Critics (e.g., Adams & Savahl, 2015; Rosa & Collado, 2019) claim that current research does not consider contextual dimensions in investigations emphasizing that they must be clearly understood to encourage children's nature engagement.

Despite substantive evidence associating childhood DNEs with long-term biodiversity conservation (Asah et al., 2018; T. Beery & Jørgensen, 2018; Broom, 2017; Evans et al., 2018; Jensen & Olsen, 2019; Sugiyama et al., 2021), research in

the Maldives has not extended to examine either children's DNEs or their potential impacts on biodiversity. Traditional practices in the Maldives corroborate that good knowledge, positive attitudes, and behavior acquired through daily DNEs are invaluable for biodiversity conservation and sustainable practices. Children were an intrinsic part of this legacy, although this status may be changing (M. Mohamed, 2012; M. Mohamed et al., 2019). Considering its significance in the Maldives (MOEE, 2015a, 2015b), combined with the potentially significant role of childhood NEs in future biodiversity conservation (Soga et al., 2016; Soga & Gaston, 2016), the need to establish the status quo among Maldivian children cannot be overstated.

1.3 Statement of the Problem

Historically, habitual DNEs in children's daily lives enabled contextualized, informal experiential learning, which fostered lasting reciprocal human-nature relationships. These relationships formed the roots of sustainable practices in the Maldives (M. Mohamed, 2012, 2015). Nevertheless, there are strong indications that present-day Maldivian children are subject to a loss of DNEs (Kagawa, 2022; M. Mohamed, 2012; M. Mohamed et al., 2019) and "disconnected from nature in their everyday lives" (Kagawa, 2022, p. 18). Furthermore, despite a long history of educational efforts to instill sustainable practices in its people, there is a lack of transformation of knowledge imparted into stewardship attitudes or behavior toward local environments (N. Mohamed & Mohamed, 2021). Childhood DNEs are fundamental for successful biodiversity conservation (Charles et al., 2018; CBD, 2018a) and ESD (Charles et al., 2018; Selby, 2017; Selby & Kagawa, 2018a, 2018b). Thus, there is an urgent need to find solutions to this disconnection between knowledge and desired outcomes and determine the role of DNEs in this problem.

Several studies support a reduction in children's DNEs based on diminished time spent in nature (Charles & Wheeler, 2012; Gundersen et al., 2016; Soga & Gaston, 2016) or the frequency of DNEs (Soga, Yamanoi, et al., 2018; Soga & Gaston, 2016; Zhang et al., 2014). Nevertheless, the real change may be related to the types of experiences (Larson et al., 2011, 2018; Novotný et al., 2021), as exemplified by New Zealand children who prefer to spend their time in gardens instead of biodiverse spaces (Hand et al., 2018). Findings indicate a decline in DNEs among Maldivian children (M. Mohamed, 2012; M. Mohamed et al., 2019). However, the specific measures of experiences, such as the frequency or types, are not investigated. They are also not founded on baselines (Larson et al., 2011) or longitudinal data (Imai et al., 2018; Skar et al., 2016) necessary for establishing clear trends. Since children's DNEs often depend on multiple contextual factors (e.g., Adams & Savahl, 2015; Collado et al., 2015; Kellert et al., 2017), baselines must also depend on these factors, which must be understood to curb negative developments.

A primary determinant of children's DNEs is urbanization. Urbanization often reduces access to nature in many ways, including city design, spatial barriers (Kellert et al., 2017), degradation of nature (Kai et al., 2014; Kellert et al., 2017; Soga, Yamanoi, et al., 2018; Soga & Gaston, 2016), and increased distance to nature spaces (Colléony et al., 2020; Soga & Gaston, 2016). Mirroring similar conditions, most present-day Maldivian children reside in overpopulated islands, where nature is continuously destroyed or modified, for instance, by reef reclamation (see MOEE, 2015a) or invasive species (Emerten et al., 2009; Sujanapal & Sankaran, 2016). These circumstances raise concerns regarding how they shape children's DNEs and shift their nature norms (see Papworth et al., 2009; Soga & Gaston, 2018). The prevalence of crime (UNESCO, 2021) and restrictions of day-to-day life, such as competitive, result-

oriented learning (Kagawa, 2022; Shareef, 2016), also raise questions regarding their impacts on children's DNEs. Meanwhile, like elsewhere, a loss of orientation to engage with nature (Soga, Yamanoi, et al., 2018; Soga & Gaston, 2016) due to lifestyle choices that compete with DNEs (Ballouard et al., 2012; Kellert et al., 2017; Larson et al., 2011; Skar et al., 2016) could be discouraging nature-engagements regardless of natural surroundings. Given their contextual basis, determinants of children's DNEs can depend on their resident *Island Environment*. Identifying these determinants is crucial to enable relevant DNEs for children as they impact many conservation-related variables, such as biodiversity knowledge (e.g., R. L. White et al., 2018).

DNEs are strongly associated with children's biodiversity knowledge (e.g., Albo et al., 2019; Almeida et al., 2018; Freeman et al., 2018; R. L. White et al., 2018). In particular, informal learning, in the context of regular DNEs in children's daily lives, can help stack up knowledge and understanding about biodiversity over time (Bartoszeck et al., 2018). Meanwhile, a deficit of DNEs leads to a loss of biodiversity knowledge (Ballouard et al., 2011; Binoy et al., 2021; Genovart et al., 2013). Traditionally, real-world experiences with rich surrounding nature enabled Maldivian children to gain knowledge and a deep understanding of local biodiversity (M. Mohamed, 2012, 2015). In contrast, today's children learn about nature and its values predominantly from schoolbooks (Kagawa, 2022; M. Mohamed, 2012, 2015) that prioritize global environmental issues. The lack of contextual interactions with the native nature in this pedagogy hinders students' understanding of local environmental concepts. A loss of traditional ecological knowledge is already noted (M. Mohamed, 2015). An erosion of biodiversity knowledge is concerning as it can negatively impact children's attitudes and willingness toward biodiversity conservation (Ballouard et al., 2012; Pam et al., 2021; Soga et al., 2020). Moreover, knowledge gained in childhood

last into adulthood and influences attitudes towards biodiversity as adults (Hosaka et al., 2017), thus, could influence the long-term conservation of resources.

Frequent DNEs often stimulate positive affective attitudes towards biodiversity in children (e.g., Barthel et al., 2018; Soga et al., 2016, 2020) and vice versa (Cornelisse & Sagasta, 2018; Soga et al., 2020; Zhang et al., 2014). However, effects often depend on the experiential contexts (Collado et al., 2015; Pam et al., 2021). Thus, unfavorable shifts in interactions and values regarding nature from sustainable to extractive ones associated with transitioning to modern times among Maldivian adults (see M. Mohamed, 2015) are likely to create conflicts in children's feelings towards biodiversity. The perspectives of youth about human-nature relationships are already transforming from local to globalized worldviews (M. Mohamed, 2015; M. Mohamed et al., 2019) and taking nature for granted (Kagawa, 2022). Furthermore, along with a lack of nature interactions in current pedagogical practices (Kagawa, 2022; M. Mohamed, 2015), children are losing their interest in environmental education (M. Mohamed, 2015). These observations indicate a progressive dwindling of traditional nature-centric attitudes towards local biodiversity. Although M. Mohamed (2015) attributes such changes to the isolation of generations of children from nature due to migration, the underlying causes of negative changes or the specific status of attitudes towards biodiversity among children remain unknown. Crucially, as nature relationships are rooted in children's daily lives, negative connections may be difficult to break once established (Moss, 2012) and are reflected in conservation-related behaviors as adults (Evans et al., 2018; Ngo et al., 2019; Sugiyama et al., 2021).

There is a notable lack of published literature on the influences of DNEs on Maldivian children's conservation-related behaviors, including their conservation willingness. A few studies report conflicting findings regarding behaviors among

youth. Some describe emerging unsustainable behaviors that conflict with cultural traditions, such as the abuse of *rizq* (divine provision) (M. Mohamed et al., 2019). Others reveal strong, sustainable citizenship behaviors. A key factor driving positive behaviors is nature interactions at a younger age (Jaufar, 2021). Regardless, negative conservation behaviors indicate an estrangement from nature (Truong & Clayton, 2020); thus, problems must be addressed at an early age. Although increased DNEs often promote children's conservation willingness (e.g., Ballouard et al., 2011; Schönfelder & Bogner, 2018; Soga et al., 2016; Zhang et al., 2014), they do not always spur positive effects (Fančovičová & Prokop, 2018; Ferreira, 2012). Instead, outcomes depend on the contexts (Fančovičová & Prokop, 2018; Pam et al., 2021) and other situational factors (Pam et al., 2021; Shapiro et al., 2016). Furthermore, the effects of DNEs on conservation willingness are often mediated by other factors, such as biodiversity knowledge (Otto & Pensini, 2017) and affective attitudes (Otto & Pensini, 2017; Soga et al., 2016; Zhang et al., 2014). Thus, it is vital to identify both the direct and indirect influences of DNEs on conservation willingness to cultivate positive behaviors. Still, investigations must be firmly grounded in understanding children's perspectives to craft effective strategies to encourage desired behaviors (Soga, Yamanoi, et al., 2018). Notably, literature from this viewpoint is sparse.

Evidently, increasing DNEs have positive effects on biodiversity knowledge, affective attitudes, and conservation willingness. However, their influence on conservation willingness is more complex, being mediated by biodiversity knowledge and affective attitudes. Meanwhile, appropriate knowledge acquired through DNEs can change negative attitudes (Albo et al., 2019; Cornelisse & Sagasta, 2018; Soga et al., 2020). Therefore, DNEs may influence conservation willingness through sequential mediating effects of biodiversity knowledge and affective attitudes.

Literature that investigates multiple relationships among these variables is not well-documented. Understanding such pathways are necessary to facilitate the types of DNEs that elicit transformative behaviors stipulated in the NCF and ESD. Understanding these paths is particularly relevant given the intentions to revise the NCF as part of the national strategies to realize the SDGs (MOEE, 2015b). For ESD to succeed in small island states, children must immerse themselves in first-hand, localized DNEs to truly understand and establish nature-protective behaviors towards their native environment (Selby, 2017; Selby & Kagawa, 2018b). Thus, a lack of childhood DNEs would challenge the customary recruitment of children as future environmental stewards in the Maldives (M. Mohamed, 2012). Nevertheless, to enable authentic DNEs, the drivers and barriers to DNEs in children's everyday lives must be identified. The lack of literature on DNEs in small island contexts, especially among Maldivian children, adds to the challenge and importance of this study.

1.4 Aims and Objectives of the Study

This study aimed primarily to establish and understand current trends in direct nature experiences and the influences of these experiences on biodiversity knowledge, attitudes towards biodiversity, and conservation willingness among 11–12-year-old school children in different *island environments* in the Maldives. A secondary aim of this study was to explore and understand the contextual factors that influence Maldivian children's nature experiences in their local island environments.

Based on the research background and aims, the specific objectives of this research are:

1. To examine the levels of direct nature experiences among children in different island environments with respect to
 - a) direct nature experience frequentness.

- b) direct nature experience types (variety of nature experiences and nature experiences with species)
- 2. To investigate the differences in
 - a) biodiversity knowledge based on direct nature experience frequentness among children.
 - b) affective attitudes based on direct nature experience frequentness among children.
 - c) conservation willingness based on direct nature experience frequentness among children.
- 3. To examine the relationship between direct nature experience types (variety of nature experiences and live nature experiences with species) and
 - a) biodiversity knowledge
 - b) affective attitudes towards biodiversity
 - c) conservation willingness
- 4. To determine the mediating effects of biodiversity knowledge and attitudes in the relationship between
 - a) direct nature experience frequentness and conservation willingness
 - b) direct nature experience types and conservation willingness
- 5. To explore the contextual factors that influence nature experiences among children in their local island environments.
- 6. To understand how contextual factors influence children's nature experiences in their local island environments.

1.5 Research Questions

The following research questions were framed to achieve the objectives:

RQ 1a: What are the levels of direct nature experience frequentness among children in different island environments?

RQ 1b: What are the levels of varieties of direct nature experiences among children in different island environments?

RQ 1c: What are the levels of direct nature experiences with species among children in different island environments?

RQ 2a: Is there any significant difference in mean biodiversity knowledge score based on direct nature experience frequentness among children?

RQ 2b: Is there any significant difference in mean affective attitudes score based on direct nature experience frequentness among children?

RQ 2c: Is there any significant difference in mean conservation willingness score based on direct nature experience frequentness among children?

RQ 3a1: Is there any significant relationship between the variety of nature experiences and biodiversity knowledge among children?

RQ 3a2: Is there any significant relationship between the variety of nature experiences and affective attitudes towards biodiversity among children?

RQ 3a3: Is there any significant relationship between the variety of nature experiences and conservation willingness among children?

RQ 3b1: Is there any significant relationship between *Seen-Alive-Only* experiences and biodiversity knowledge among children?

RQ 3b2: Is there any significant relationship between *Seen-Alive-Only* experiences and affective attitudes towards biodiversity among children?

RQ 3b3: Is there any significant relationship between *Seen-Alive-Only* experiences and conservation willingness among children?

RQ 4a: What are the mediating effects of biodiversity knowledge and affective attitudes in the relationship between direct nature experience frequentness and conservation willingness?

RQ 4b: What are the mediating effects of biodiversity knowledge and affective attitudes in the relationship between direct nature experience types and conservation willingness?

RQ 5: What contextual factors influence nature experiences among children in their local island environments?

RQ 6: How do contextual factors influence nature experiences among children in their local island environments?

1.6 Hypotheses

There are no hypotheses for Research Question 1. The following hypotheses were formulated for Research Questions 2 to 4.

For Research Question 2

H_{01a} : There is no significant difference in mean biodiversity knowledge scores based on direct nature experience frequentness among children.

H_{a1b} : There is no significant difference in mean affective attitudes scores based on direct nature experience frequentness among children.

H_{a1c} : There is no significant difference in the mean conservation willingness scores based on direct nature experience frequentness among children.

For Research Question 3

H_{02a1} : There is no significant relationship between the variety of nature experiences and biodiversity knowledge among children.

H_{02a2} : There is no significant relationship between the variety of nature experiences and affective attitudes towards biodiversity among children.

H_{02a3} : There is no significant relationship between the variety of nature experiences and conservation willingness among children.

H_{02b1} : There is no significant relationship between *Seen-Alive-Only* experiences and biodiversity knowledge among children.

H_{02b2} : There is no significant relationship between *Seen-Alive-Only* experiences and affective attitudes towards biodiversity among children.

H_{02b3} : There is no significant relationship between *Seen-Alive-Only* experiences and conservation willingness among children.

For Research Question 4

H_{03a1} : The indirect effect of *Experience Frequentness* on conservation willingness through biodiversity knowledge is zero.

H_{03a2} : The indirect effect of *Experience Frequentness* on conservation willingness through affective attitudes is zero.

H_{03a3} : The indirect effect of the *Experience Frequentness* on conservation willingness through biodiversity knowledge and affective attitudes in

sequence, with biodiversity knowledge affecting affective attitudes, is zero.

H_{03a4} : The direct effect of *Experience Frequentness* on conservation willingness without passing through either biodiversity knowledge or affective attitudes is zero.

H_{03b1} : The indirect effect of the variety of nature experiences on conservation willingness through biodiversity knowledge is zero.

H_{03b2} : The indirect effect of the variety of nature experiences on conservation willingness through affective attitudes is zero.

H_{03b3} : The indirect effect of the variety of nature experiences on conservation willingness through biodiversity knowledge and affective attitudes in sequence, with biodiversity knowledge affecting affective attitudes, is zero.

H_{03b4} : The direct effect of the variety of nature experiences on conservation willingness without passing through either biodiversity knowledge or affective attitudes is zero.

H_{03c1} : The indirect effect of *Seen-Alive-Only* experiences on conservation willingness through biodiversity knowledge is zero.

H_{03c2} : The indirect effect of *Seen-Alive-Only* experiences on conservation willingness through affective attitudes is zero.

H_{03c3} : The indirect effect of *Seen-Alive-Only* experiences on conservation willingness through biodiversity knowledge and affective attitudes in sequences, with biodiversity knowledge affecting affective attitudes, is zero.

H_{a3c4}: The direct effect of *Seen-Alive-Only* experiences on conservation willingness without passing through either biodiversity knowledge or affective attitudes is zero.

1.7 Significance of the Study

The findings of this study contribute to the academic information base on nature experiences among children in the context of SD, ESD, and biodiversity conservation in the Maldives and to the broader global context of vulnerable island environments. Establishing baselines on DNEs, biodiversity knowledge, affective attitudes, and conservation willingness and factors that influence DNEs in children following a sustainability-targeted curriculum in the Maldives adds to the significance of this study. Levels of species identification knowledge are low among children, as are affective attitudes and conservation willingness in general. The study found that several species were not seen alive by many children regardless of the island. By examining multiple contexts of children's nature experiences, this study uncovered that increased frequency and types of DNEs positively influence biodiversity knowledge, affective attitudes, and conservation willingness. Confirming a predictive sequential pathway from DNE to conservation willingness through biodiversity knowledge and affective attitudes is particularly significant. The path supports that nature experiences must be afforded in meaningful ways to stimulate the affective domain of attitudes through experiential learning to transform knowledge into positive conservation behavior.

This study has practical implications for several stakeholders of society to strategize optimal avenues for children to explore nature within the constraints they may face at the level of each island. The implications for educators and curriculum

developers are many, given the role of education in achieving a sustainable future. Although opportunities primarily influence children's DNEs, societal constraints hinder children's independent use of nature in their proximity. Hence, the responsibility of providing opportunities to experience nature befalls squarely in schools. In particular, formal changes need to be made at the level of policies and curricula to effectuate this change. The findings may guide practitioners to facilitate DNEs through formal and informal means to foster children's love for nature, positive attitudes, and behavior necessary for protecting the vulnerable biodiversity of this country. These attributes are necessary to realize the key competencies and the successful internalization of sustainable practices stipulated in the Maldivian NCF (NIE, 2014). This study can be a resource base for educators to strategize effective ways to mainstream biodiversity education in the formal curriculum and model responsible, environmentally proactive citizens through pedagogical designs. Other disciplines may draw from the findings for purposes other than biodiversity conservation, such as health and wellbeing.

The findings contribute to understanding nature experiences in children's everyday lives and their outcomes through the lens of Experiential Learning Theory, Kellert's Model, and the Environmental Competency Model, none of which are well-known. Hopefully, this study would catalyze local researchers and policymakers to focus on efforts to understand and plan the best practices that enhance DNEs and establish much-needed, coherent, systematic, and streamlined educational programs to foster biodiversity conservation in the Maldives.

1.8 Operational Definitions

In this research, the following operational definitions were used.

1.8.1 Island Environments

This construct is based on representations of nature that children may encounter in their everyday lives found in the literature (e.g., Collado et al., 2016; Gundersen et al., 2016; Imai et al., 2018).

In this study, *Island Environment* is defined as the prevailing natural environment of children and represents nature that is available for regular experiences in the study site. Variations in local nature include natural ecosystems such as mangroves, marshy habitats, wooded areas, indigenous fauna and flora, parks, home gardens, tree lines on streets, school grounds, and features unique to the island (adapted from citations above). These variations may depend on urbanization, population, and infrastructural aspects on each island. In this study, the *type of island environment* is defined as different island environments based on the elements discussed above.

1.8.2 Direct Nature Experiences

DNEs have been defined in many ways but often involve informal firsthand interactions with nature in everyday lives (Longbottom & Slaughter, 2016).

In this study, *Direct Nature Experiences (DNEs)* are defined as children's activities involving direct physical contact with the nature available in their island environment, in its wild or managed state, whether they are planned or unplanned (adapted from Kellert, 2005; Rosa & Collado, 2019; Soga et al., 2016; Zhang et al., 2014).