

Records of birds in Quang Nam Chau proposed Species and Habitat conservation area, Quang Ninh province, northeastern Vietnam

Hoang Trung Thanh^{1*}, Le Khac Quyen¹, Ly Ngoc Tu², Ha Manh Truong³

¹University of Science, Vietnam National University, Ha Noi, 334 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam

²Hanoi Metropolitan University, 98 Duong Quang Ham, Cau Giay, Hanoi, Vietnam

³Remote Sensing & Information Technology Center, Forest Inventory and Planning Institute

* Correspondence to Hoang Trung Thanh <hoangtrungthanh@hus.edu.vn>

(Received: 05 May 2023; Revised: 23 May 2025; Accepted: 01 July 2023)

Abstract. Quang Nam Chau is a proposed species and habitat conservation area located in Quang Ninh province, northeastern Vietnam. The area is covered by primary forest and plays an important role in watershed protection. However, there has not been any previous ornithological study conducted in the area. This study was carried out in October and November 2021 to investigate the diversity of bird species and identify the current threats to avifauna and biodiversity in Quang Nam Chau. A total of 121 bird species belonging to 47 families and 17 orders were identified, with Passeriformes (73 species, 60.3%) and Muscicapidae (11 species, RDi = 9.09) being the most diverse order and family, respectively. Five of the 121 recorded species were globally threatened, and 29 were nationally rare and/or threatened. The avifauna and general biodiversity of the region are threatened by illegal hunting and trapping, agriculture expansion, grazing, and non-timber resource exploitation.

Keywords: bird species, diversity, composition, threats, Quang Nam Chau, northeastern Vietnam

1 Introduction

Birds play various crucial roles in ecosystems, such as acting as predators, pollinators, scavengers, seed dispersers, seed predators, and ecosystem engineers, apart from being significant to humans. Migratory bird species also connect ecosystem processes that are geographically and temporally separated 1Whelan CJ, Wenny DG, Marquis RJ. Ecosystem services provided by birds. *Annals of the New York Academy of Sciences*. 2008;1134:25-60.. However, the world's bird species have been experiencing a steady decline, with highly endangered species becoming extinct and formerly widespread ones declining sharply 2. In this regard, protected areas have been contributing significantly to conserving birds in some of the world's most diverse and threatened terrestrial ecosystems 3.

The Quang Nam Chau region is located in Binh Lieu, Hai Ha, and Dam Ha districts of Quang Ninh province, northeastern Vietnam. It is mainly covered by primary forest and serves as a vital watershed protection forest in the area. To protect the important watershed protection forest and conserve the biological diversity of the region, Quang Nam Chau is currently being proposed as a species and habitat conservation area. It is believed to have a rich diversity of flora and fauna, including mammals, reptiles, amphibians, and birds 4. However, there have been no ornithological studies conducted in the area. Therefore, this study aims to determine the bird species composition and identify the current threats to avifauna and biodiversity in Quang Nam Chau. The results of this study will provide essential data on the area's biodiversity and

conservation status to managers, which will help improve management strategies and ensure the area's biodiversity sustainability in the future.

2 Materials and methods

The research was conducted in the main parts of the proposed Quang Nam Chau species and habitat conservation area in Binh Lieu, Hai Ha, and Dam Ha districts of Quang Ninh province, including Dong Van, Hoanh Mo, and Huc Dong communes of Binh Lieu district; Quang Son and Quang Duc communes of Hai Ha district; and Quang Lam and Quang An communes of Dam Ha district.

To capture birds, mist nets of different sizes (3.0-5.0 m height x 9.0-20.0 m length, mesh size 16 mm x 16 mm) were used and were set up during the morning (5 a.m.) and late afternoon (4 p.m.) when birds are most active. Captured birds were carefully removed from the nets, photographed, and provisionally identified before being released. Bird species were also recorded and identified through line transect surveys and point surveys conducted across different types of habitats in each part of the area during the morning (5 a.m. – 10 a.m.), afternoon (3 p.m. – 6 p.m.), and evening to observe nocturnal birds. Threats to avifauna, their habitats, and biodiversity were noted during the line transect surveys. Additionally, interviews were conducted to gather information about the common and characteristic bird species, their status, bird exploitation, and other human-related activities in the region.

The identification of bird species was based on their morphological characteristics, such as feather pattern, size, shape, color, and sound. Nikon binoculars were used for observation, and photographs were taken using digital cameras (Nikon D850 + telezoom 200-500mm; Nikon Coolpix P1000). Bird identification followed the

guidelines of Nguyen Cu et al. 5, Robson 6, Le Manh Hung et al. 7.

Bird taxonomy and nomenclature following Clements et al. 8. Bird species conservation status following IUCN Red List version 2021-3 8, Vietnam Red Data Book 2007 10, Decree 06/2019/ND-CP 11 and Decree 84/2021/ND-CP 12.

The relative diversity index (RDi) of bird families was calculated following La Torre-Cuadros et al. 13 using the formula below:

$$RDi = \frac{\text{Number of bird species in a family}}{\text{Total number of species}} \times 100$$

3 Results and discussion

3.1 Bird species diversity

Bird species diversity in Quang Nam Chau was high, with 121 bird species from 47 families and 17 orders recorded (Table 1). This is the first data on the avifauna of the region. The area supports about 13.2% (121/916) of bird species reported from Vietnam 14. Of the total 121 species identified, 113 species were recorded through photos taken in the field, direct observation, hearing the sound, or recorded from specimens. Eight species were recorded only through interviews or referred to from previous documents (Table 1).

3.2 Bird species composition

Our study found that the Passeriformes order had the highest number of species (73 species, comprising 60.3% of the total species), followed by Accipitriformes (10 species, 8.3%), and Strigiformes (5 species, 4.1%). Other orders had from one to four species, comprising 0.8 - 3.3% of the total bird species recorded in Quang Nam Chau (Fig. 1). These results suggest that the area has a high potential for supporting diverse avifauna.

Table 1. List of bird species recorded in Quang Nam Chau, Quang Ninh province, northeastern Vietnam

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
	GALLIFORMS ORDER - BỘ GÀ	GALLIFORMES				
	Pheasant Family - Họ Trĩ	Phasianidae				
1)	Rufous-throated Partridge (Gà so họng hung)	<i>Arborophila rufogularis</i>			IIB	S, O, I
2)	Grey Peacock Pheasant (Gà tiền mặt vàng)	<i>Polyplectron bicalcaratum</i>		VU	IB	I
3)	Red Junglefowl (Gà rừng)	<i>Gallus gallus</i>				S, O, I
4)	Silver Pheasant (Gà lôi trắng)	<i>Lophura nycthemera</i>		LR/c d	IB	P, I, C
	GREBES ORDER - BỘ LE HÔI	PODICIPEDIFORMES				
	Grebes family - Họ Le hôi	Podicipedidae				
5)	Little Grebe (Le hôi)	<i>Tachybaptus ruficollis</i>				O, P
	COLUMBIFORM ORDER - BỘ BÒ CÂU	COLUMBIFORMES				
	Columbiform family - Họ Bò câu	Columbidae				
6)	Spotted Dove (Cu gáy)	<i>Streptopelia chinensis</i>				O
7)	Emerald Dove (Cu luồng)	<i>Chalcophaps indica</i>				O
8)	Thick-billed Pigeon (Cu xanh mỏ quặp)	<i>Treron curvirostra</i>				O
	CUCKOO ORDER - BỘ CU CU	CUCULIFORMES				
	Cuckoo family - Họ Cu cu	Cuculidae				
9)	Greater Coucal (Bìm bịp lớn)	<i>Centropus sinensis</i>				O
10)	Lesser Coucal (Bìm bịp nhỏ)	<i>C. bengalensis</i>				O
11)	Green-billed Malkoha (Phuon)	<i>Phaenicophaeus tristis</i>				O, P
12)	Plaintive Cuckoo (Tim vịt)	<i>Cacomantis merulinus</i>				S
	CAPRIMULGIFORM ORDER - BỘ CÚ MUỐI	CAPRIMULGIFORMES				
	Swift Family - Họ Yến	Apodidae				
13)	White-throated Needletail (Yến đuôi cứng họng trắng)	<i>Hirundapus caudacutus</i>				O, P
14)	Asian Palm Swift (Yến cọ)	<i>Cypsiurus balasiensis</i>				O
	GRUIFORM ORDER - BỘ SẾU	GRUIFORMES				
	Rail family - Họ Gà nước	Rallidae				
15)	White-breasted Waterhen (Cuốc ngực trắng)	<i>Amaurornis phoenicurus</i>				O

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
	CHARADRIIFORM ORDER - BỘ RỄ	CHARADRIIFORMES				
	Buttonquail family - Họ cun cú	Turnicidae				
16)	Barred Buttonquail (Cun cú lưng nâu)	<i>Turnix suscitator</i>				S
	Sandpipers - Họ rẽ	Scolopacidae				
17)	Eurasian Woodcock (Nhát bà)	<i>Scolopax rusticola</i>				O
	Larids - Họ Mòng bể	Laridae				
18)	Relict Gull (Mòng bể relic)	<i>Ichthyaelus relictus</i>	VU	DD		[1]
	BỘ BỒ NÔNG	PELECANIFORMES				
	Họ Diệc	Ardeidae				
19)	Black-crowned Night Heron (Vạc)	<i>Nycticorax nycticorax</i>				O
20)	Black Bittern (Cò hương)	<i>Ixobrychus flavicollis</i>				O
21)	Chinese Pond Heron (Cò bọ)	<i>Ardeola bacchus</i>				O, P
	BỘ ƯNG	ACCIPITRIFORMES				
	Họ Ưng	Accipitridae				
22)	Oriental Honey Buzzard (Điều ăn ong)	<i>Pernis ptilorhynchus</i>			IIB	O, P
23)	Jerdon's Baza (Điều hoa Jerdon)	<i>Aviceda jerdoni</i>			IIB	O
24)	Crested Serpent Eagle (Điều hoa Miến điện)	<i>Spilornis cheela</i>			IIB	O, P
25)	Mountain Hawk Eagle (Điều núi)	<i>Nisaetus nipalensis</i>			IIB	O
26)	Changeable Hawk Eagle (Điều đầu nâu)	<i>Spizaetus cirrhatus</i>			IIB	P, C
27)	Imperial Eagle (Đại bàng đầu nâu)	<i>Aquila heliaca</i>	VU	CR	IB	O
28)	Crested Goshawk (Ưng ấn độ)	<i>Accipiter trivirgatus</i>			IIB	O, P
29)	Japanese Sparrowhawk (Ưng nhật bản)	<i>A. gularis</i>			IIB	O
30)	Northern Goshawk (Ưng lớn)	<i>A. gentilis</i>			IIB	O, C
31)	Brahminy Kite (Điều lửa)	<i>Haliastur indus</i>			IIB	O
	BỘ CÚ	STRIGIFORMES				
	Họ Cú mèo	Strigidae				
32)	Collared Scops Owl (Cú mèo khoang cổ)	<i>Otus bakkamoena</i>			IIB	S, O, P
33)	Asian Barred Owlet (Cú vọ)	<i>Glaucidium cuculoides</i>			IIB	S
34)	Collared Owlet (Cú vọ mặt trắng)	<i>G. brodiei</i>			IIB	S
	Họ Cú lợn	Tytonidae				
35)	Eastern Grass Owl (Cú lợn lưng nâu)	<i>Tyto capensis</i>		VU	IIB	[1]

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
36)	Barn Owl (Cú lợn lưng xám)	<i>T. alba</i>			IIB	Sp, [1]
	BỘ NUỐC	TROGONIFORMES				
	Họ Nước	Trogonidae				
37)	Red-headed Trogon (Nuốc bụng đỏ)	<i>Harpactes erythrocephalus</i>				S
	BUCEROTIFORM (BỘ HỒNG HOÀNG)	BUCEROTIFORMES				
	Họ Hồng hoàng	Bucerotidae				
38)	Great Hornbill (Hồng hoàng)	<i>Buceros bicornis</i>	VU	VU	IB	[1], I
	BỘ SÁ	CORACIIFORMES				
	Họ Bói cá	Alcedinidae				
39)	Common Kingfisher (Bồng chanh)	<i>Alcedo atthis</i>				O
40)	White-throated Kingfisher (Sả đầu nâu)	<i>Halcyon smyrnensis</i>				S
	BỘ GỖ KIẾN	PICIFORMES				
	Họ Cu rốc	Megalaimidae				
41)	Green-eared Barbet (Thầy chùa đầu xám)	<i>Psilopogon faiostrictus</i>				O, S
	Họ Gõ kiến	Picidae				
42)	White-browed Piculet (Gõ kiến lùn mày trắng)	<i>Sasia ochracea</i>				O, P
	BỘ CẮT	FALCONIFORMES				
	Họ Cắt	Falconidae				
43)	Eurasian Kestrel (Cắt lưng hung)	<i>Falco tinnunculus</i>			IIB	O, P
44)	Amur Falcon (Cắt Amur)	<i>F. amurensis</i>			IIB	O, P
45)	Eurasian Hobby (Cắt Trung quốc)	<i>F. subbuteo</i>			IIB	O
46)	Peregrine Falcon (Cắt lớn)	<i>F. peregrinus</i>			IB	O
	BỘ VỆT	PSITTACIFORMES				
	Họ Vẹt	Psittaculidae				
47)	Red-breasted Parakeet (Vẹt ngực đỏ)	<i>Psittacula alexandri</i>	NT		IIB	[1], I
48)	Gray-headed Parakeet (Vẹt đầu xám)	<i>P. finschii</i>	NT		IIB	[1]
	BỘ SẺ	PASSERIFORMES				
	Họ Giả phồng chèo	Vangidae				
49)	Bar-winged Flycatcher-shrike (Phồng chèo đen)	<i>Hemipus picatus</i>				O
	Họ Phồng chèo	Campephagidae				
50)	Scarlet Minivet (Phồng chèo đỏ lớn)	<i>Pericrocotus flammeus</i>				O, P

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
51)	Grey-chinned Minivet (Phường chèo má xám)	<i>P. solaris</i>				O, P
	Họ Bách thanh	Laniidae				
52)	Brown Shrike (Bách thanh mày trắng)	<i>Lanius cristatus</i>				O
53)	Long-tailed Shrike (Bách thanh đuôi dài)	<i>L. schach</i>				O
	Họ Khướu mỏ quặp	Vireonidae				
54)	White-bellied Erpornis (Khướu mỏ bụng trắng)	<i>Erpornis zantholeuca</i>				O, P
	Họ Chèo bẻo	Dicruridae				
55)	Black Drongo (Chèo bẻo)	<i>Dicrurus macrocercus</i>				O
56)	Ashy Drongo (Chèo bẻo xám)	<i>D. leucophaeus</i>				O, P
57)	Hair-crested Drongo (Chèo bẻo bờm)	<i>D. hottentottus</i>				O, P
	Họ Rẻ quạt	Rhipiduridae				
58)	White-throated Fantail (Rẻ quạt họng trắng)	<i>Rhipidura albicollis</i>				O, P
	Họ Thiên đường	Monarchidae				
59)	Asian Paradise Flycatcher (Thiên đường đuôi phướn)	<i>Terpsiphone paradisi</i>				O, P
	Họ Quạ	Corvidae				
60)	White-winged Magpie (Giẻ cùi vàng)	<i>Urocissa whiteheadi</i>				O, P
61)	Common Green Magpie (Giẻ cùi xanh)	<i>Cissa chinensis</i>				O, P
62)	Large-billed Crow (Quạ)	<i>Corvus macrorhynchos</i>				O, P
	Họ Bạc má	Paridae				
63)	Great Tit (Bạc má)	<i>Parus major</i>				O
	Họ Chào mào	Pycnonotidae				
64)	Black-crested Bulbul (Chào mào vàng mỏ đen)	<i>Pycnonotus melanicterus</i>				O, P
65)	Red-whiskered Bulbul (Chào mào)	<i>P. jocosus</i>				O
66)	Light-vented Bulbul (Bông lau Trung quốc)	<i>P. sinensis</i>				O, P
67)	Puff-throated Bulbul (Cành cạch lớn)	<i>Alophoixus pallidus</i>				O, P, Sp
68)	Chestnut Bulbul (Cành cạch hung)	<i>Hemixos castanonotus</i>				O, P, Sp
	Họ Nhạn	Hirundinidae				
69)	Barn Swallow (Nhạn bụng trắng)	<i>Hirundo rustica</i>				O

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
70)	Red-rumped Swallow (Nhạn bụng xám)	<i>H. daurica</i>				O
71)	Asian House Martin (Nhạn hông trắng Á châu)	<i>Delichon dasypus</i>				O, P
	Họ Chích đớp ruồi	Cettidae				
72)	Yellow-bellied Warbler (Chích đớp ruồi bụng vàng)	<i>Abroscopus superciliaris</i>				O, P
73)	Mountain Tailorbird (Chích bông đầu vàng)	<i>Phyllergates cucullatus</i>				O, P
	Họ Chim chích	Phylloscopidae				
74)	Bianchi's Warbler (Chích đớp ruồi đầu xám)	<i>Phylloscopus valentini</i>				O, P
75)	Sulphur-breasted Warbler (Chích ngực vàng)	<i>P. ricketti</i>				O
76)	Yellow-browed Warbler (Chích mày lớn)	<i>P. inornatus</i>				O
77)	Blyth's Leaf Warbler (Chích đuôi xám)	<i>P. reguloides</i>				O, P
	Họ Chiền chiện	Cisticolidae				
78)	Hill Prinia (Chiền chiện núi họng trắng)	<i>Prinia superciliaris</i>				O, P
79)	Rufescent Prinia (Chiền chiện đầu nâu)	<i>P. rufescens</i>				O
80)	Common Tailorbird (Chích bông đuôi dài)	<i>Orthotomus sutorius</i>				O
81)	Dark-necked Tailorbird (Chích bông cánh vàng)	<i>O. atrogularis</i>				O
	Họ Khướu mỏ cong	Timaliidae				
82)	Black-streaked Scimitar Babbler (Hoạ mi đất ngực luốc)	<i>Pomatorhinus ruficollis</i>				S, O, P
83)	Gray-throated Babbler (Khướu bụi đầu đen)	<i>Stachyris nigriceps</i>				O
84)	Spot-necked Babbler (Khướu bụi đốm cổ)	<i>S. striolata</i>				O, P
85)	Rufous-capped Babbler (Khướu bụi đầu đỏ)	<i>Cyanoderma ruficeps</i>				O, P, Sp
86)	Golden Babbler (Khướu bụi vàng)	<i>C. chrysaeum</i>				O, P, Sp
87)	Pin-striped Tit Babbler (Chích chạch má vàng)	<i>Mixornis gularis</i>				O
	Họ Chuối tiêu	Pellorneidae				
88)	David's Fulvetta (Lách tách má xám)	<i>Alcippe davidi</i>				O, P, Sp
89)	Eyebrowed Wren Babbler (Khướu đá)	<i>Napothera epilepidota</i>				O, P

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
	nhỏ)					
90)	Buff-breasted Babbler (Chuối tiêu đất)	<i>Pellorneum tickelli</i>				O, P
	Họ Khướu	Leiothrichidae				
91)	Blue-winged Minla (Khướu lùn cánh xanh)	<i>Actinodura cyanouroptera</i>				O
92)	Silver-eared Mesia (Kim oanh tai bạc)	<i>Leiothrix argenteauris</i>			IIB	O, S
93)	Black-throated Laughingthrush (Khướu bạc má)	<i>Ianthocincla chinensis</i>			IIB	O
	Họ Khướu mỏ dẹt	Sylviidae				
94)	Short-tailed Parrotbill (Khướu mỏ dẹt đuôi ngắn)	<i>Neosuthora davidiana</i>				O, P
	Họ vành khuyên	Zosteropidae				
95)	Indochinese Yuhina (Khướu mỏ khoang cổ)	<i>Yuhina torquedula</i>				O, P
96)	Black-chinned Yuhina (Khướu mỏ mặt đen)	<i>Y. nigrimenta</i>				O, Sp
97)	Japanese White-eye (Vành khuyên Nhật Bản)	<i>Zosterops japonicus</i>				O, P
	Họ Hoét	Turdidae				
98)	Siberian Thrush (Hoét Sibêri)	<i>Geokichla sibirica</i>				O
99)	Grey-backed Thrush (Hoét lưng đen)	<i>Turdus hortulorum</i>				O
	Họ Sáo	Sturnidae				
100)	Hill Myna (Yểng, nhồng)	<i>Gracula religiosa</i>			IIB	I
	Họ Đớp ruồi	Muscicapidae				
101)	Taiga Flycatcher (Đớp ruồi Taiga)	<i>Ficedula albicilla</i>				O, P
102)	Asian Brown Flycatcher (Đớp ruồi nâu)	<i>Muscicapa dauurica</i>				O
103)	Dark-sided Flycatcher (Đớp ruồi Sibêri)	<i>M. sibirica</i>				O
104)	Small Niltava (Đớp ruồi trán đen)	<i>Niltava macgrigoriae</i>				O
105)	Large Niltava (Đớp ruồi lớn)	<i>N. grandis</i>				O
106)	Verditer Flycatcher (Đớp ruồi xanh xám)	<i>Eumyias thalassinus</i>				O, P
107)	Slaty-backed Forktail (Chích chòe nước trán trắng)	<i>Enicurus schistaceus</i>				O, P
108)	Plumbeous Water Redstart (Đuôi đỏ đầu xám)	<i>Phoenicurus fuliginosus</i>				O, P
109)	Grey Bushchat (Sẻ bụi xám)	<i>Saxicola ferreus</i>				O

No.	Common name (English and Vietnamese)	Scientific name	Conservation status			Notes
			(1)	(2)	(3)	
110)	Siberian Stonechat (Sẻ bụi đầu đen)	<i>S. torquatus</i>				O, P
111)	White-rumped Shama (Chích chòe lửa)	<i>Copsychus malabaricus</i>				[1], I
	Họ Chim sâu	Dicaeidae				
112)	Plain Flowerpecker (Chim sâu vàng lục)	<i>Dicaeum minullum</i>				O
	Họ Hút mật	Nectariniidae				
113)	Streaked Spiderhunter (Bấp chuối đốm đen)	<i>Arachnothera magna</i>				O, P
114)	Fork-tailed Sunbird (Hút mật đuôi nhọn)	<i>Aethopyga christinae</i>				O, P, Sp.
	Họ Sẻ	Passeridae				
115)	Eurasian Tree Sparrow (Sẻ)	<i>Passer montanus</i>				O
	Họ Chim di	Estrildidae				
116)	White-rumped Munia (Di cam)	<i>Lonchura striata</i>				O
117)	Scaly-breasted Munia (Di đá)	<i>L. punctulata</i>				O
	Họ Chia vôi	Motacillidae				
118)	Gray Wagtail (Chia vôi núi)	<i>Motacilla cinerea</i>				O, P
119)	White Wagtail (Chia vôi trắng)	<i>M. alba</i>				O
120)	Richard's Pipit (Manh lớn)	<i>Anthus richardi</i>				O
121)	Olive-backed Pipit (Manh Vân Nam)	<i>A. hodgsoni</i>				O, P
	Total		5	6	28	

Conservation status: (1) - IUCN Red List version 2021-3; (2) - Vietnam Red Data Book 2007: CR – Critical Endangered, VU – Vulnerable, NT – Near Threatened, LR/cd – Low Risk/conservation dependent, DD – Data Deficient; (3) - Decree 06/2019/ND-CP and Decree 84/2021/ND-CP amending Decree 06/2019/ND-CP: Appendix I - species threatened with extinction, prohibited from export, import, re-export, introduction from the sea and transit of natural specimens for commercial purposes; Appendix II - species that, although currently not threatened with extinction, may become so without control of export, import, re-export, introduction from the sea and transit of natural specimens thereof for commercial purposes;

Notes: O - species recorded by observation; P - species recorded with photo; I - species recorded by interview; S - species recorded by sound; Sp – Species recorded with specimen; C – species with birds in captive; [1] - Quang Ninh provincial people's committee, 2017.

In terms of bird families, Muscicapidae was the most diverse family in Quang Nam Chau, with 11 species recorded (Relative Diversity index, RDi = 9.09). Accipitridae followed with 10 species (RDi = 8.26), while Timaliidae and Pycnonotidae had 6 and 5 species, respectively (RDi = 4.96 and RDi = 4.13). Most of the other

families were poorly represented, with only one to four species recorded (RDi = 0.83 – 3.31) (see Table 2). Among the genera, *Falcon* had the highest number of bird species (*F. tinnunculus*, *F. amurensis*, *F. subbuteo*, *F. peregrinus*) followed by *Phylloscopus* (*P. valentini*, *P. ricketti*, *P. inornatus*, *P. reguloides*).

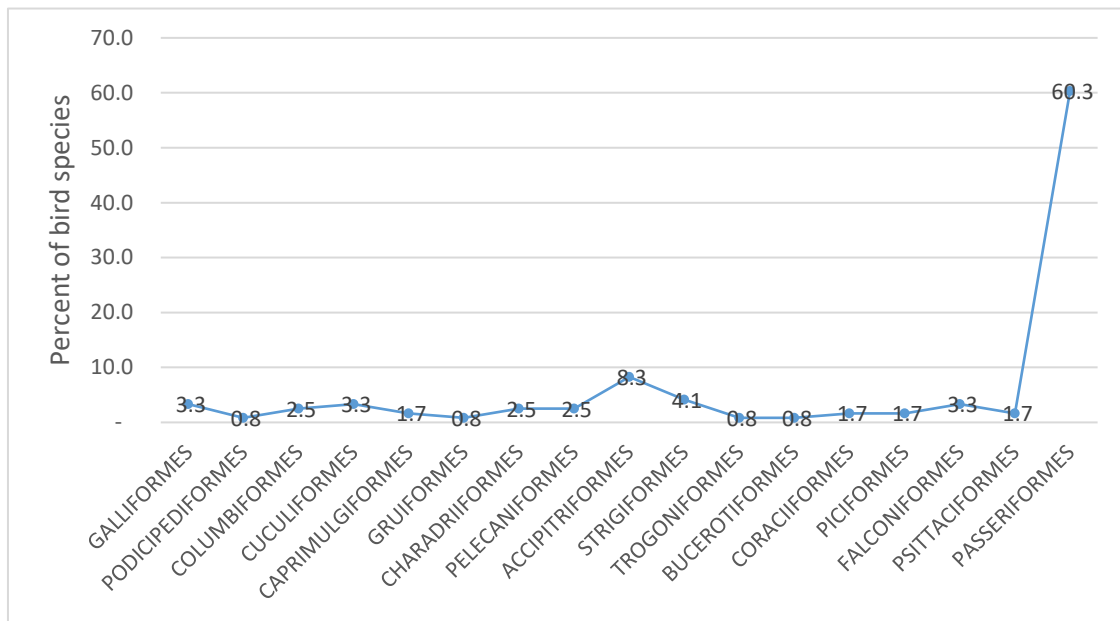


Fig. 1. Bird species composition (orders) in Quang Nam Chau

Table 2. Relative diversity index (RDi) of bird families in Quang Nam Chau, Quang Ninh province, northeastern Vietnam

Bird families	Number of species	Relative diversity index (RDi)
Muscicapidae	11	9.09
Accipitridae	10	8.26
Timaliidae	6	4.96
Pycnonotidae	5	4.13
Phasianidae, Cuculidae, Falconidae, Phylloscopidae, Cisticolidae, Motacillidae	4	3.31
Columbidae, Ardeidae, Strigidae, Dicruridae, Corvidae, Hirundinidae, Pellorneidae, Leiothrichidae, Zosteropidae	3	2.48
Apodidae, Tytonidae, Alcedinidae, Psittaculidae, Campephagidae, Laniidae, Cettidae, Turdidae, Nectariniidae, Estrildidae	2	1.65
Podicipedidae, Rallidae, Turnicidae, Scolopacidae, Laridae, Trogonidae, Bucerotidae, Megalaimidae, Picidae, Vangidae, Vireonidae, Rhipiduridae, Monarchidae, Paridae, Sylviidae, Sturnidae, Dicaeidae, Passeridae	1	0.83

3.3 Conservation status and threats on avifauna in Quang Nam Chau

In this study, a total of 121 bird species were recorded in Quang Nam Chau, and among them, 29 species were identified as rare and/or threatened species, accounting for 24% of the total

species (Table 1). Five of these species were listed in the IUCN Red List version 2021-3 8, including *Ichthyaetus relictus* and *Aquila heliaca* and *Buceros bicornis*, which were categorized as VU; and *Psittacula alexandri* and *P. finschii*, which were categorized as NT. Six species were listed in

Vietnam Red Data Book 2007 10, including *Aquila heliaca*, which was categorized as CR; *Polyplectron bicalcaratum*, *Tyto capensis* and *Buceros bicornis*, which were categorized as VU; *Lophura nycthemera*, which was categorized as LR/cd; and *Ichthyaetus relictus*, which was categorized as DD. Moreover, 27 species were listed in Decree 06/2019/ND-CP 11 and Decree 84/2021/ND-CP 12 on the management of endangered, precious, and rare forest plants and animals (Table 1). Of the 29 rare and/or threatened bird species identified in this study, 22 were directly observed during the field survey, while the remaining seven were reported through interviews or cited in the literature (see Table 1). These findings suggest that Quang Nam Chau has the potential to support a diverse bird avifauna, including both common and threatened species, and could play a valuable role in conserving biodiversity at both national and global levels.

Hunting and trapping, agriculture expansion, grazing, and disturbance by non-timber resources exploitation were found to be the main threats to bird species and biodiversity in Quang Nam Chau. These factors were partly in agreement with threats to biodiversity in Vietnam and were also highlighted by other studies 15-17. Hunting and trapping were identified as the major threats, having a direct impact on bird species and other animals (amphibian, reptiles, mammals) in the region.

This study provided baseline information for improving management strategies, monitoring biodiversity, and planning conservation activities in Quang Nam Chau, although more intensive and long-term studies on bird species in the region are necessary.

4 Conclusions

The study conducted in Quang Nam Chau identified a total of 121 bird species from 47

families and 17 orders, with Passeriformes and Muscicapidae being the order and family with the highest number of species, respectively. Of these, 29 species were nationally rare and/or threatened, and five were globally threatened. Hunting and trapping, agriculture expansion, grazing, and disturbance caused by non-timber resource exploitation were identified as major threats to bird species and biodiversity in the region.

Acknowledgement

We would like to express our gratitude to Nguyen Cao Tung and the staff members of the Remote Sensing & Information Technology Center, as well as Le Manh Tuan of the Forest Resources and Environment Center at the Forest Inventory and Planning Institute. We also thank the managers and staff members of the Forest Protection Department of Dam Ha, Hai Ha, and Binh Lieu districts in Quang Ninh province for their invaluable support.

References

1. Whelan CJ, Wenny DG, Marquis RJ. Ecosystem services provided by birds. *Annals of the New York Academy of Sciences*. 2008;1134:25-60.
2. BirdLife International. *State of the world's birds: taking the pulse of the planet*. UK: BirdLife International; 2008.
3. Cazalis V, Princé K, Mihoub JB, Kelly J, Butchart SH, Rodrigues AS. Effectiveness of protected areas in conserving tropical forest birds. *Nat Commun*. 2020;11(1):1-8.
4. Quang Ninh provincial people's committee. *General report on biodiversity conservation planning in Quang Ninh province to 2020, orientation to 2030*. Quang Ninh: Quang Ninh provincial people's committee; 2017 (in Vietnamese).
5. Cu N, Trai LT, Phillipps K. *Birds of Vietnam*. Hanoi: BirdLife International Vietnam Programme; 2000 (in Vietnamese).

6. Robson C. A Field Guide to the Birds of Thailand and South-East Asia. UK: New Holland Publishers Ltd; 2008.
7. Hung LM, Tien BD, Hiep NM, Pau TA, Tuan TA. Birds of Vietnam. Hanoi: Nha Nam & The gioi Publishing houses; 2020 (in Vietnamese).
8. Clements JF, Schulenberg TF, Iliff MJ, Billerman SM, Fredericks TA, Gerbracht JA, Lepage D, Sullivan BL, Wood CL. The eBird/Clements checklist of birds of the world: v2022; 2022. Available from : <https://www.birds.cornell.edu/clementschecklist/download/>
9. IUCN. IUCN Red List of Threatened Species. Version 2021-3; 2022. Available from : <https://www.iucnredlist.org>
10. Ministry of Science and Technology & Vietnam Academy of Science and Technology. Vietnam Red Data Book, Part1 Animals. Hanoi: Natural Science and Technology Publishing House; 2007 (in Vietnamese).
11. Government of Vietnam. Decree No. 06/2019/ND-CP dated January 22, 2019 of the Government on the management of endangered, precious and rare forest plants and animals and implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; 2019 (in Vietnamese).
12. Government of Vietnam. Decree No. 84/2021/ND-CP dated September 22, 2021 Amendments to Decree 6/2019/ND-CP dated 22 January 2019 of the Government on the management of endangered, precious and rare forest plants and animals and the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; 2021 (in Vietnamese).
13. La Torre-Cuadros M, Herrando-Pérez S, Young K. Diversity and structural patterns for tropical montane and premontane forests of central Peru, with an assessment of the use of higher-taxon surrogacy. *Biodiversity and Conservation*. 2007; 16:2965-2988.
14. Craik R, Minh L. Birds of Vietnam. Lynx and Birdlife, International Field Guides. Barcelona: Lynx Editions; 2018.
15. Ministry of Natural Resources and Environment. National Environmental Status Report 2016-2020. Hanoi: Dan tri publisher; 2021 (in Vietnamese).
16. Sterling EJ, Hurley MM, Minh LD. Vietnam - A Natural History. New Haven and London: Yale University Press; 2008.
17. Thuaire B, Allanic Y, Hoang VA, Le KQ, Luu HT, Nguyen TC, et al. Assessing the biodiversity in Viet Nam – Analysis of the impacts from the economic sectors. Hanoi: WWF-Viet Nam; 2021.