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SUPPLEMENTARY ONLINE MATERIAL FOR

**New Pleistocene bird fossils in Taiwan
reveal unexpected seabirds in East Asia**

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Supplementary Online Material

SOM 1.

Table S1. Modern *Gavia* specimens for fossil identification.

Table S2. Records of modern *Gavia* in Taiwan region (Taiwan and Orchid Islands) since 1860s.

Table S3. The Pleistocene Gaviidae in the world.

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Table S1. Modern *Gavia* specimens for fossil identification. Abbreviations: NHMUK, Natural History Museum, Tring, United Kingdom; YIO, Yamashina Institute for Ornithology.

Species	Institute	ID
<i>G. adamsii</i>	YIO	63205, 74354
<i>G. arctica</i>	YIO	63204, 64755, 64757, 72000, 73424, 79597, 79600
<i>G. immer</i>	NHMUK	1850.5.19.11, 1852.12.5.19, 1870.6.22.6, 1909.3.29.1, 1930.3.24.77, S/1987.13.1, S/2013.1.1
<i>G. pacifica</i>	YIO	60621, 61919, 61920, 61921, 61922, 64763, 65229, 71298, 72201, 72222, 73437, 73792, 78761, 79599
<i>G. stellata</i>	YIO	73438, 78792, 78793, 79598

Table S2. Records of modern *Gavia* in Taiwan region (Taiwan and Orchid Islands) since 1860s. The number of records is defined as the number of occurrences. '*' indicates the accurate localities of occurrence are not accessible. Abbreviations: MSP, Min Sheng Pao; NTM, National Taiwan Museum Digital Archive Information System; TBN, Taiwan Biodiversity Network.

Year	Island(s)	Site	Species	Number	Reference
1861-1862	Taiwan	northern Taiwan*	<i>G. stellata</i>	several	Swinhoe 1863
1970-1971	Taiwan	northern Taiwan*	<i>G. arctica</i>	1	Yen 1984
1996	Taiwan	Tainan	<i>G. arctica</i>	1	Chu 1996
2004	Taiwan	Zhuangwei	<i>G. stellata</i>	1	Chao 2006
2008	Taiwan	Jiaoxi	<i>G. arctica</i>	2	TBN 2023
2008	Taiwan	Toucheng	<i>G. arctica</i>	10	TBN 2023
2010	Taiwan	Wanli	<i>G. stellata</i>	5	NTM 2023; TBN 2023
2010	Taiwan	Gongliao	<i>G. arctica</i>	1	TBN 2023
2013	Taiwan	Shoufeng	<i>G. arctica</i>	1	TBN 2023
2014	Orchid	Lanyu	<i>G. stellata</i>	1	TBN 2023
2015	Taiwan	Wanli	<i>G. stellata</i>	6	TBN 2023
2016	Taiwan	Wanli	<i>G. stellata</i>	4	TBN 2023
2017	Taiwan	Anle	<i>G. stellata</i>	2	TBN 2023
2018	Taiwan	Gongliao	<i>G. stellata</i>	2	TBN 2023

Table S3. The Pleistocene Gaviidae in the world. Abbreviations: eP, early Pleistocene; H, Holocene; IP, late Pleistocene; mP, middle Pleistocene; P, Pleistocene.

Age	Nation	Locality	Source
<i>G. arctica</i>			
IP	U.S.	California (San Miguel Island, San Pedro)	Miller 1914; Howard 1949; Guthrie 1992
		Denmark	Ertebølle, Fannerup, Klintesoe, Maglemose, Mejlgaard, Soelager
	Germany	Neddenaverbergen	Fischer and Mauersberger 1989
	Italy	Puglia, Salerno	Gala and Tagliacozzo 2010
	Russia	Bryansk, Krasnoyarsk	sensu Tyrberg 1998
	Spain	Vizcaya	sensu Tyrberg 1998
	Switzerland	Neuchâtel	sensu Tyrberg 1998
	U.K.	Wales	Harrison 1987
	Ukraine	Hintsi	Soffer 1985
IP-H	Italy	Calabria	Gala and Tagliacozzo 2010
	Netherlands	Westenschouwen en Nieuw-Haamstede, Zandmotor	Langeveld et al. 2017; Langeveld 2020
	U.K.	Derbyshire	sensu Tyrberg 1998

Table S3. (Continued)

Age	Nation	Locality	Source
<i>G. arctica?</i>			
IP	U.S.	California (Newport Bay)	Howard 1949
	Italy	Grotta dei Colombi	sensu Tyrberg 1998
<i>G. cf. arctica</i>			
IP	U.S.	California (Manix Lake)	Jefferson 1985
<i>G. concinna</i>			
eP	U.S.	Florida (Forsberg Shell Pit, Leisey Shell Pit)	Emslie 1995, 1998
<i>G. immer</i>			
eP	Russia	Chukotka	Harington 1978
	U.S.	California (Lomita Sand Pit)	Howard 1944
IP	Denmark	Maglemose	Winge 1903; Lambrecht 1933
	U.S.	Alabama (Bell Cave), California (Newport Bay), Florida (Cutler Hammock, Rock Springs)	Howard 1949, 1958; Woolfenden 1959; Parmalee 1992; Emslie 1998
	France	Landes	Altuna et al. 1991
IP-H	California	San Miguel Island	Guthrie 1998, 2005
	Ireland	Edenvale	Bell 1915
	Netherlands	Zandmotor	Langeveld 2020

Table S3. (Continued)

Age	Nation	Locality	Source
P	Norway	Vardo	Lambrecht 1933
	U.S.	Florida (Lake Monroe, Wakulla Spring), Maryland (Calvert)	Brodkorb 1953, 1963; Wetmore 1962
<i>G. cf. immer</i>			
IP	U.S.	California (Del Rey Hill, San Pedro)	Miller 1914; Howard 1936
<i>G. pacifica</i>			
eP	U.S.	Florida (Ingris)	Emslie 1998
IP	U.S.	California (San Miguel Island)	Guthrie 1992, 2005
	Japan	Chiba	Ono et al. 1984
<i>G. stellata</i>			
eP	Taiwan	Chiayi	This study
mP	U.K.	Norfolk	Newton 1883
m-IP	Japan	Shiriya	Hasegawa et al. 1988
IP	Belgium	Overmere	Gautier 1995
	U.S.	California (Newport Bay)	Howard 1958
	Czech	Moravia	sensu Tyrberg 1998
	Denmark	Ertebølle, Gudumlund, Havelse, Havnoe, Klintesoe, Mejlgaard, Soelager	Winge 1903
	Germany	Baden-Württemberg, Schleswig-Holstein	sensu Tyrberg 1998

Table S3. (Continued)

Age	Nation	Locality	Source
IP	Italy	Liguria, Puglia	Lambrecht 1933; Tyrberg 1998; Gala and Tagliacozzo 2010
	Netherlands	Niedersachsen	Geel et al. 2006
	Portugal	Setubal	Mourer-Chauviré and Antunes 2000
	Russia	Bryansk	sensu Tyrberg 1998
	Spain	Gibraltar	sensu Tyrberg 1998
	U.K.	Essex	Lambrecht 1933
	IP-H	Ireland	Waterford
Italy		Calabria	Gala and Tagliacozzo 2010
Netherlands		De Banjaard, Steenbanken, Westenschouwen en Nieuw- Haamstede, Zandmotor	Langeveld et al. 2017, 2021; Cardol 2018; Langeveld 2020
U.K.		Norfolk	Newton 1883

Table S3. (Continued)

Age	Nation	Locality	Source
<i>G. stellata?</i>			
mP	Japan	Chiba	Watanabe et al. 2020
IP	Italy	Grotta dei Colombi	Lambrecht 1933
	Spain	Malaga	sensu Tyrberg 1998
<i>G. cf. stellata</i>			
m-IP	Japan	Shiriyu	Watanabe et al. 2018
IP	Romania	Caras-Severin	sensu Tyrberg 1998
<i>aff. G. stellata</i>			
eP	Japan	Shizuoka	Matsuoka et al. 2007
<i>G. arctica/immer</i>			
IP	France	Isturitz	sensu Tyrberg 1998
IP-H	Netherlands	De Banjaard	Langeveld 2020
<i>G. arctica/stellata</i>			
IP-H	Netherlands	Zandmotor	Langeveld 2020
	U.K.	Derbyshire	sensu Tyrberg 1998
<i>G. sp.</i>			
eP	Japan	Ishikawa	Matsuura 1996
	Taiwan	Chiayi	This study
	Ukraine	Cherson	sensu Tyrberg 1998
m-IP	Germany	Thüringen	sensu Tyrberg 1998

Table S3. (Continued)

Age	Nation	Locality	Source
IP	Belgium	Namur	sensu Tyrberg 1998
	U.S.	California (Palos Verdes Sand, U.S. Veterans Hospital), Virginia (Eclipse)	Langenwalter 1975; Eshelman and Grady 1986
	Germany	Sachsen-Anhalt	sensu Tyrberg 1998
	Italy	Sardegna	sensu Tyrberg 1998
	Monaco	Grotte de l'Observatoire	Boule and Villeneuve 1927; Lambrecht 1933
	Switzerland	Schaffhausen	sensu Tyrberg 1998
	U.K.	Renfrewshire, Yorkshire	Smith 1862; Lambrecht 1933
	IP-H	Mexico	Tlapacoya
Spain		Gibraltar	sensu Tyrberg 1998
Yakutia		Djuktai Cave	Zelenkov et al. 2008
P	U.S.	Arizona (Benson), California (Rancho La Brea)	Lambrecht 1933

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