Dataset of long-term bird monitoring in Qigu wetlands, Taiwan

七股濕地長期鳥類監測調查資料集

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Abstract

Qigu, located on the southwest coast of Taiwan, is one of the internationally significant sites in the East Asian-Australasian Flyway. Various types of waterbirds inhabit this region due to its distributed natural wetlands and periodically drained fish farms. Qigu also supports approximately 15-20% of the wintering population of the globally endangered black-faced spoonbills (*Platalea minor*) and has been designated as an Important Bird Area (IBA) by BirdLife International. Taiwan Endemic Species Research Institute (TESRI) (currently known as Taiwan Biodiversity Research Institute, TBRI) initiated a long-term systematic bird monitoring project in Qigu in 2015. In the period from April, 2015, to March, 2021, monthly bird censuses were conducted at six

sampling sites within Qigu, resulting in 432 sampling events and 11,533 occurrence records. A total of 100,601 bird individuals, representing 120 species across 36 families, were counted and documented. The most dominant family is Ardeidae, followed by Scolopacidae, Anatidae, Recurvirostridae, and Charadriidae.

Keywords: Aves, bird census, southwest coast of Taiwan, Important Bird Area, fish farms

摘要

七股地處臺灣西南沿海，有豐富的天然濕地與定期曬池魚塭分布，為許多遷徙性水鳥提供良好棲地，是東亞澳遷徙線上之重要節點。國際瀕危鳥種黑面琵鷺每年約有 15-20% 的度冬族群棲息於七股，國際鳥盟亦將此地劃設為重要野鳥棲地。特有生物研究保育中心（農業部生物多樣性研究所前身）於 2015 年 4 月開始執行七股濕地之長期鳥類監測計畫，於 6 個調查樣點進行每月 1 次之鳥類調查，截至 2021 年 3 月累計進行 432 次樣點調查，取得 11,533 筆鳥類調查紀錄，包含 36 科 120 種 100,601 隻次。其中最優勢的科別為鷺科，其次依序為鷸科、鴨科、長腳鷸科及鴴科。

關鍵詞：鳥類、鳥類監測調查、西南沿海、重要野鳥棲地、魚塭

Introduction

The East Asian-Australasian Flyway (EAAF), stretching from eastern Russia to New Zealand, is one of the globally recognized flyways for migratory waterbirds (Boere and Stroud 2006). The EAAF is used by approximately 201 species of waterbirds (Kirby *et al.* 2008), and the total number of shorebirds within this flyway is estimated to be at least 8 million (Bamford *et al.* 2008). However, populations of many waterbird species in this major flyway are undergoing rapid decline (Wilson *et al.* 2011; Clemens *et al*. 2016). Long-term systematic monitoring for waterbirds within the EAAF is therefore necessary for population tracking and conservation decision-making (Hansen *et al*. 2016).

Qigu, located on the southwest coast of Taiwan, is one of the internationally significant sites in the EAAF (Bamford *et al*. 2008). This region is full of natural wetlands and periodically drained fish farms, therefore providing habitats for various types of waterbirds (Huang and Hsueh 2014). Qigu supports approximately 15-20% of the wintering population of the globally endangered black-faced spoonbills (*Platalea minor*) (Yu *et al*. 2021; Taiwan Black-Faced Spoonbill Conservation Association 2021), and has been designated as an Important Bird Area (IBA) by BirdLife International (Chan *et al*. 2004).

Although the importance of Qigu in supporting migratory waterbirds has been well-recognized, long-term population data for most species in this region are still insufficient. Therefore, Taiwan Endemic Species Research Institute (TESRI) (currently known as Taiwan Biodiversity Research Institute, TBRI) initiated a long-term systematic bird monitoring project in Qigu in 2015. In the period from April, 2015, to March, 2021, (72 months in total), monthly bird censuses were conducted at six sampling sites within Qigu, resulting in 432 sampling events and 11,533

occurrence records. A total of 100,601 bird individuals, representing 120 species across 36 families, were counted and documented (Fig. 1 & Fig. 2). All of these records were organized into an open dataset using Darwin Core (DwC) Archive format. This monitoring project is still in progress, and the dataset may be updated in the future.

Project details

Project title: Long-term bird monitoring project in Qigu wetlands

Funding: Funding from the Endemic Species Research Institute, Council of Agriculture, Executive Yuan, R.O.C. (Taiwan).

Study area description: The study area of this project is the southwestern part of Qigu District (in Tainan City), which is located on the southwest coast of Taiwan (23.07206°N to 23.10149°N, 120.03645°E to 120.08831°E). The landscape of this region is composed of various natural and artificial wetlands (e.g. fish farms), and therefore provides suitable habitats for waterbirds, especially those migrating along the East Asian–Australasian Flyway (EAAF). Based on the weather data of the past 10 years (2013-2022) from the Qigu weather station (23.14719°N, 120.08619°E), the average temperature here is 24.1°C. The month with lowest temperature is January (17.3°C), while the month with highest temperature is July (29.2°C). The average annual precipitation is 1510.2 mm, and the seasonality of precipitation is typically obvious. From May to September, the monthly precipitation is above 160 mm, but it declines to less than 80 mm from October to April.

Design description: This project is meant to establish baseline data of the avian community in the Qigu wetlands by means of long-term periodic bird censuses at selected sampling sites.

Taxonomic coverage

General taxonomic coverage

description: A total of 120 bird species, spanning 36 families and 16 orders, are included in this dataset. The most dominant family (the family with the most individuals recorded) is Ardeidae (27,654), followed by Scolopacidae (15,777), Anatidae (12,074), Recurvirostridae (9,617), and Charadriidae (8,326). The family with the most species recorded is Scolopacidae (25 species), followed by Ardeidae (11 species), Charadriidae (8 species), Anatidae (7 species), and Laridae (7 species) (Table 1). The most dominant species is little egret (*Egretta garzetta*), followed by great egret (*Ardea alba*), black-winged stilt (*Himantopus himantopus*), Kentish plover (*Charadrius alexandrinus*), and Eurasian tree sparrow (*Passer montanus*).

Spatial coverage

General spatial coverage: The dataset includes sampling events in the southwestern part of Qigu District (in Tainan City), which is located on the southwest coast of Taiwan.

Coordinates: 23.07206°N to 23.10149°N (latitude); 120.03645°E to 120.08831°E (longitude).

Temporal coverage:

April 29, 2015-March 8, 2021

Methods

Study extent description: Six representative sites within southwestern Qigu District were selected as the sampling sites of this monitoring project (as shown in column “locality” of the DwC Occurrence Extension), including Lighthouse Fish Farms (LHF), North Fish Farms (NFF), East Fish Farms (EFF), Qigu Levee (QGL), American Fish Farm Ruins (AFR), and American Fish Farms (AFF) (Fig. 3). Bird censuses were conducted once a month at these six sampling sites from April, 2015, to March, 2021. The main habitat type within these sampling sites are fish farms for clams (*Meretrix lusoria*) or milkfish

(*Chanos chanos*), while the habitat environment still slightly differs between sites (more details in Table 2).

Sampling method description: The monthly bird censuses at LHF, NFF, EFF, and QGL were conducted using transect method (as shown in column "samplingProtocol" of the DwC Event Core). These transects are usually trails beside fish farms (at LHF, NFF, EFF) or along the levee (at QGL), with the length ranging from 0.826 km to 3.129 km. In contrast, monthly censuses at AFR and AFF were conducted using counting flocks method, which means counting flocks of birds within a predefined area. The sampling areas of AFR and AFF are 9.8 ha and 22.4 ha, respectively (Table 2). Bird censuses were all conducted during daytime (mostly between 9 a.m. and 5 p.m.), with no strict limitation on the starting time and duration of each census.

Quality control description: All of the monthly bird censuses were carried out by one to three experienced and well-trained bird observers. To keep the quality steady, only five observers (including two main observers and three occasionally assistant observers) have been involved during the time coverage of this dataset (April, 2015, to March, 2021). All of the occurrence records were integrated and examined after each census. Any uncommon or abnormal records will be confirmed, and modifications will be made if necessary. The taxonomy information in this dataset is organized based on the eBird Taxonomy v2022 (Clements *et al*. 2022) and the 2023 TWBF Checklist of the Birds of Taiwan (Ding *et al*. 2023).

Method step description: All of the six sampling sites and the corresponding census methods were determined at the beginning of this project. For the transect censuses (at LHF, NFF, EFF, and QGL), a team of observers walked along a predefined transect and recorded the birds nearby. For the

counting flocks censuses (at AFR and AFF), observers counted and recorded the birds within a predefined area, which is typically composed of several fish farms. Observers used binoculars (typically 10x42) and/or monoculars (20-60x) to detect and observe birds in all censuses, and recorded bird species as well as the number of individuals. Birds seen or heard by the observers were all recorded, except for those birds only flying through sampling area without perching or foraging behaviors. The weather condition determined by visual observation was also recorded for each census (presented as a categorical variable in the DwC Measurement or Facts Extension). Each monthly census at each of the six sampling sites is regarded as a sampling event (as shown in column "eventID" of the DwC Event Core). It should be noted that from April, 2015, to around June, 2018, all of the bird occurrences within a single sampling event were recorded at the same coordinate, which is the centroid coordinate of the sampling site. However, the bird occurrences were recorded at the coordinate of several distinct locations, which correspond to different sections along the transect or different districts within the site, since around June, 2018 (the time points slightly differ between sampling sites, see Table 2 & Table 3 for details). The change of recording protocol can be observed through columns "locationID," "decimalLatitude," and "decimalLongitude" of the DwC Occurrence Extension.

Dataset

Dataset description

Object name: Darwin Core Archive Dataset of long-term bird monitoring in Qigu wetlands, Taiwan

Character encoding: UTF-8

Format name: Darwin Core Archive format

Format version: 1.0

Distribution:

https://www.gbif.org/dataset/346c95be-c7b3-41dc-99c9-e88a18d8884a (GBIF)
https://doi.org/10.15468/4a97qb (DOI)
https://ipt.taibif.tw/resource?r=cgbs_tesri_2021 (TaiBIF IPT)

Publication date of data: 2023-07-20

Language: English

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Metadata language: English

Date of metadata creation: 2023-07-20

Hierarchy level: Dataset

Darwin Core Terms used in the dataset:

eventID, parentEventID, eventDate, eventTime, samplingProtocol, sample SizeValue, sampleSizeUnit, country, countryCode (**DwC Event Core**); occurrenceID, type, basisOfRecord, locationID, locality, decimalLatitude, decimalLongitude, coordinate UncertaintyInMeters, geodeticDatum, verbatimCoordinateSystem, coordinate Precision, order, family, scientificName, vernacularName, individualCount, taxonRank, recordedBy (**DwC Occurrence Extension**); measurement ID, measurementType, measurement Value, measurementUnit, measurement DeterminedDate, measurement DeterminedBy, measurementMethod, measurementRemarks (**Dw C Measurement or Facts Extension**).

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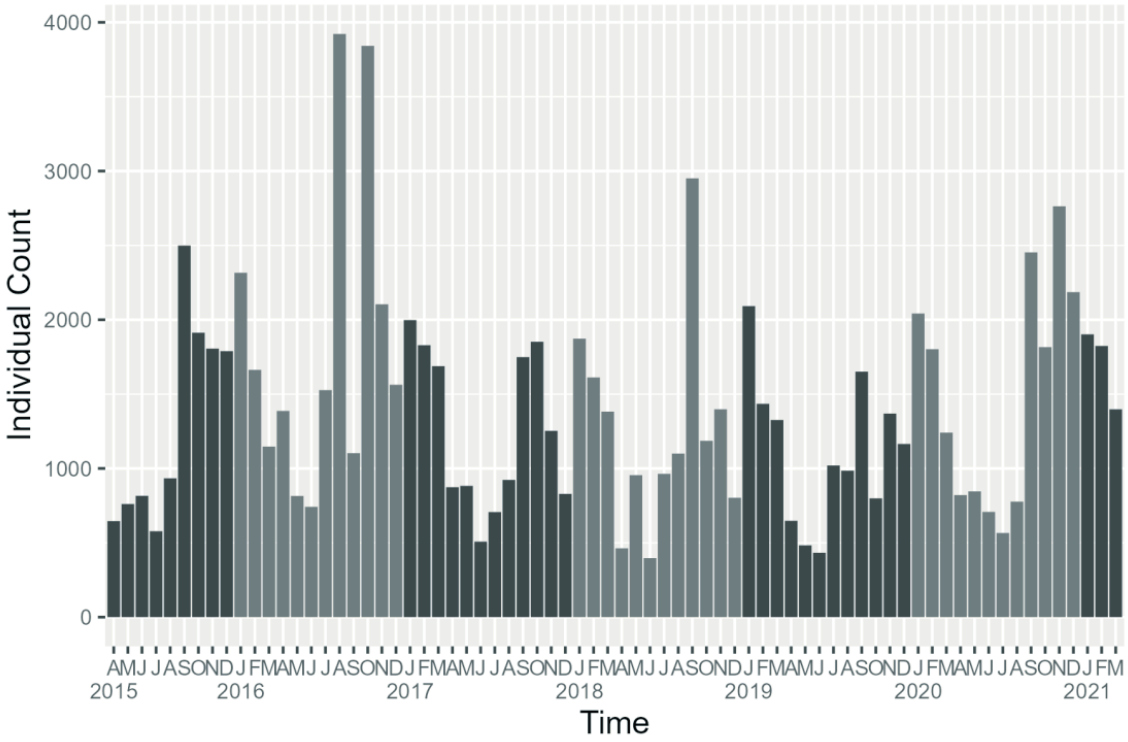

Fig. 1. Individual count of birds in each month from April, 2015, to March, 2021.
圖 1、2015 年 4 月至 2021 年 3 月間逐月鳥類調查隻次。

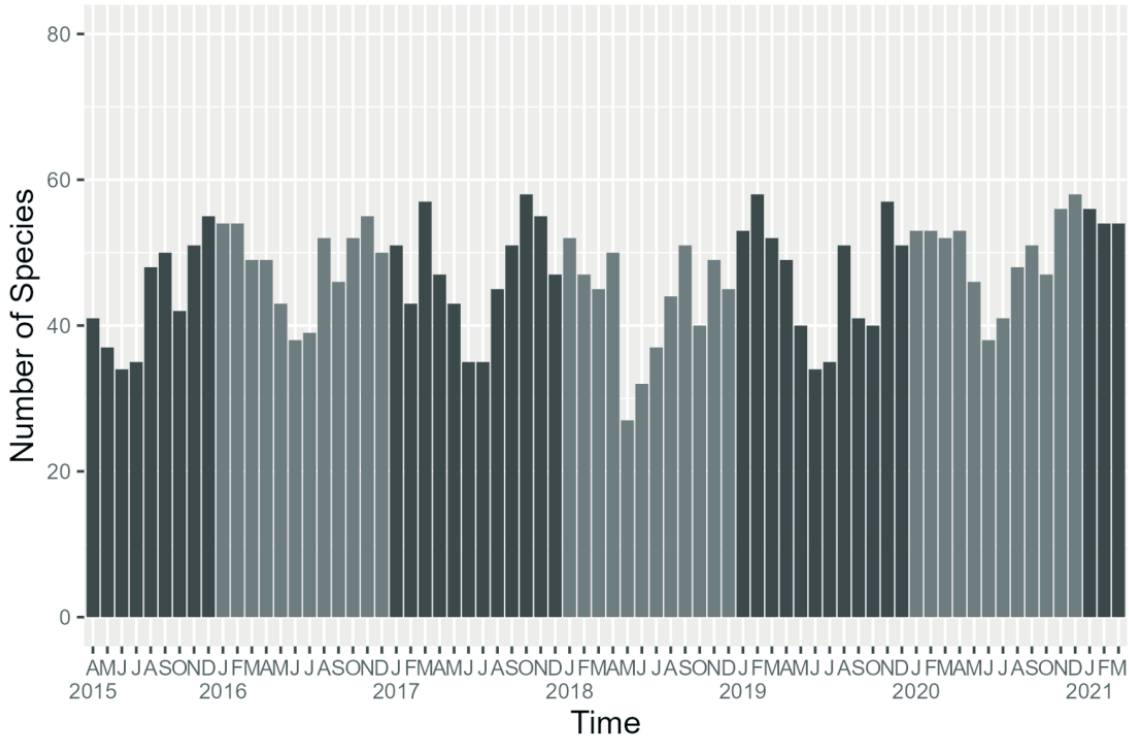

Fig. 2. Number of species recorded in each month from April, 2015, to March, 2021.
圖 2、2015 年 4 月至 2021 年 3 月間逐月鳥類調查物種數。

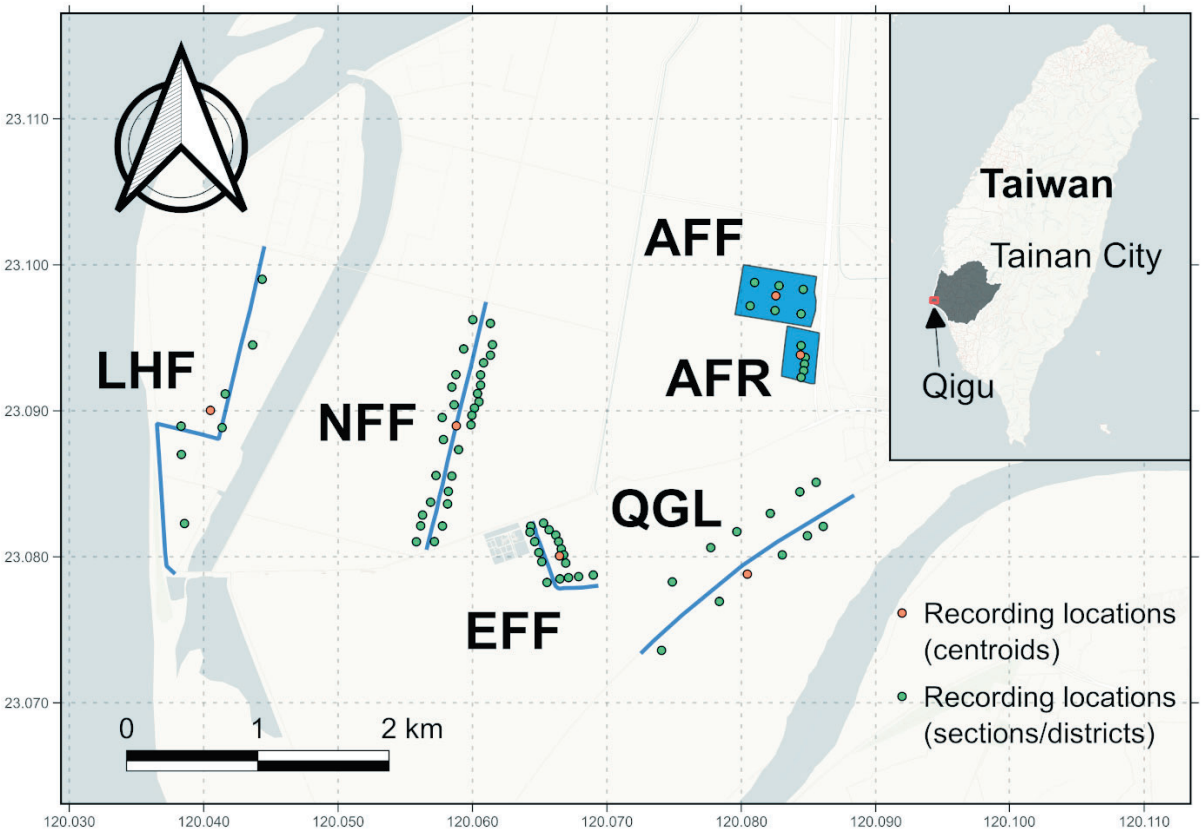

Fig. 3. Distribution of sampling sites and recording locations.
圖 3、調查樣點及記錄座標位置圖。

Table 1. List of orders and families in the dataset with numbers of species and individual counts.
表 1、資料集內目、科、每科物種數及個體隻次列表。

Order	Family	No. of Species	Individual Count
Anseriformes	Anatidae	7	12,074
Galliformes	Phasianidae	1	88
Podicipediformes	Podicipedidae	1	1,349
Columbiformes	Columbidae	3	2,681
Cuculiformes	Cuculidae	1	11
Gruiformes	Rallidae	5	962
Charadriiformes	Recurvirostridae	2	9,617
	Charadriidae	8	8,326
	Rostratulidae	1	40
	Jacanidae	1	1
	Scolopacidae	25	15,777
	Glareolidae	1	56
	Laridae	7	3,855
Suliformes	Phalacrocoracidae	1	6
Pelecaniformes	Ardeidae	11	27,654
	Threskiornithidae	3	5,040
Accipitriformes	Pandionidae	1	9
	Accipitridae	4	172
Bucerotiformes	Upupidae	1	1
Coraciiformes	Alcedinidae	1	45
Piciformes	Picidae	1	9
Falconiformes	Falconidae	1	12
Psittaciformes	Psittacidae	1	1
Passeriformes	Dicruridae	2	402
	Laniidae	2	432
	Corvidae	1	209
	Alaudidae	1	116
	Cisticolidae	4	1,012
	Hirundinidae	4	1,279

Pycnonotidae	1	1,337
Zosteropidae	1	446
Sturnidae	5	2,187
Muscicapidae	3	74
Estrildidae	2	932
Passeridae	1	4,275
Motacillidae	5	114

Table 2. List of sampling sites and associated information.
表 2、調查樣點列表及相關資訊。

Site Code	Site Name	Habitat Type	Census Method	Length/ Area	Centroid Coordinate (WGS 84)	Census Period	Recording Location
LHF	Lighthouse Fish Farms	fish farms (clams, milkfish, shrimps); abandoned fish farms	transect	3.129 km	23.09003°N, 120.04050°E	2015/04~ 2018/06	1 location: LHF
						2018/07~ 2021/03	7 locations: LHF01, LHF02, LHF03, LHF04, LHF05, LHF06, LHF07
NFF	North Fish Farms	fish farms (clams)	transect	1.904 km	23.08897°N, 120.05879°E	2015/04~ 2018/09	1 location: NFF
						2018/10~ 2021/03	29 locations: NFFc01, NFFc02, NFFc03, NFFc04, NFFc05… NFFc30 (There is no NFFc08 because it was combined with NFFc07.)
EFF	East Fish Farms	fish farms (clams)	transect	0.826 km	23.08006°N, 120.06647°E	2015/04~ 2018/07	1 location: EFF
						2018/08~ 2021/03	17 locations: EFFa01, EFFa02, EFFa03, EFFa04, EFFa05… EFFa17
QGL	Qigu Levee	abandoned fish farms; farmland	transect	1.997 km	23.07881°N, 120.08044°E	2015/04~ 2018/06	1 location: QGL
						2018/07~	7 locations:

		(shallots)				2019/02	QGL01, QGL02, QGL03, QGL04, QGL05, QGLAF, QGLFL
						2019/03~ 2021/03	9 locations: QGL01, QGL02, QGL03, QGL04, QGL05, QGLAF1, QGLAF2, QGLFL1, QGLFL2
AFR	American Fish Farm Ruins	abandoned fish farms	counting flocks	9.82 ha	23.09383°N, 120.08439°E	2015/04~ 2018/06	1 location: AFR
						2018/07~ 2021/03	5 locations: AFR00, AFR01, AFR02, AFR03, AFR04
AFF	American Fish Farms	fish farms (milkfish fingerlings)	counting flocks	22.4 ha	23.09788°N, 120.08256°E	2015/04~ 2018/07	1 location: AFF
						2018/08~ 2021/03	6 locations: AFFf01, AFFf02, AFFf03, AFFf04, AFFf05, AFFf06

Table 3. Coordinates (WGS84) of recording locations.
表 3、紀錄點位的經緯度座標（WGS84）

Recording Location	Latitude (degree)	Longitude (degree)	Recording Location	Latitude (degree)	Longitude (degree)
LHF	23.09003	120.04050	EFFa03	23.08104	120.06462
LHF01	23.08228	120.03857	EFFa04	23.08029	120.06493
LHF02	23.08701	120.03834	EFFa05	23.07966	120.06515
LHF03	23.08895	120.03832	EFFa06	23.07824	120.06554
LHF04	23.08885	120.04137	EFFa07	23.08231	120.06528
LHF05	23.09116	120.04160	EFFa08	23.08185	120.06569
LHF06	23.09451	120.04364	EFFa09	23.08149	120.06619
LHF07	23.09901	120.04435	EFFa10	23.08104	120.06640
NFF	23.08897	120.05879	EFFa11	23.08054	120.06660
NFFc01	23.09624	120.06002	EFFa12	23.08013	120.06678
NFFc02	23.09424	120.05934	EFFa13	23.07957	120.06693
NFFc03	23.09248	120.05876	EFFa14	23.07849	120.06650
NFFc04	23.09163	120.05846	EFFa15	23.07857	120.06714
NFFc05	23.09041	120.05863	EFFa16	23.07864	120.06789
NFFc06	23.08954	120.05774	EFFa17	23.07875	120.06898
NFFc07	23.08803	120.05783	**QGL**	23.07881	120.08044
NFFc09	23.08557	120.05728	QGL01	23.07359	120.07406
NFFc10	23.08374	120.05688	QGL02	23.07828	120.07486
NFFc11	23.08286	120.05628	QGL03	23.07694	120.07836
NFFc12	23.08212	120.05614	QGL04	23.08063	120.07772
NFFc13	23.08103	120.05582	QGL05	23.08172	120.07966
NFFc14	23.09599	120.06133	QGLAF	23.08445	120.08435
NFFc15	23.09453	120.06148	QGLAF1	23.08510	120.08556
NFFc16	23.09381	120.06133	QGLAF2	23.08297	120.08215
NFFc17	23.09329	120.06082	QGLFL	23.08144	120.08491
NFFc18	23.09246	120.06060	QGLFL1	23.08208	120.08609
NFFc19	23.09176	120.06060	QGLFL2	23.08013	120.08304
NFFc20	23.09118	120.06037	**AFR**	23.09383	120.08439
NFFc21	23.09062	120.06048	AFR00	23.09447	120.08444

NFFc22	23.09019	120.06014	AFR01	23.09366	120.08475
NFFc23	23.08969	120.05995	AFR02	23.09320	120.08469
NFFc24	23.08904	120.05988	AFR03	23.09275	120.08463
NFFc25	23.08734	120.05896	AFR04	23.09229	120.08444
NFFc26	23.08553	120.05846	**AFF**	23.09788	120.08256
NFFc27	23.08448	120.05820	AFFf01	23.09832	120.08460
NFFc28	23.08362	120.05814	AFFf02	23.09857	120.08280
NFFc29	23.08211	120.05776	AFFf03	23.09879	120.08098
NFFc30	23.08104	120.05716	AFFf04	23.09664	120.08444
EFF	23.08006	120.06647	AFFf05	23.09687	120.08250
EFFa01	23.08210	120.06433	AFFf06	23.09719	120.08065
EFFa02	23.08169	120.06427			