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Seabirds in the seas around Sri Lanka: their interaction in pelagic fisheries

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The present appraisal study was undertaken by the National Aquatic Resources Research and Development Agency (NARA) covering a period of one year (2013/2014) to assess the impact of large pelagic fisheries on the survival of seabirds. This study was carried out to comply with the Resolution 12/06 on reducing the incidental bycatch of seabirds in longline fisheries. Data was collected from port sampling and also from onboard observation in research cruises made in Sri Lankan coastal waters and Bay of Bengal in Indian Ocean and also on commercial fishing vessels.

Being a tropical oceanic island in the Indian Ocean a large number of seabird species are reported from the coastal seas around the Sri Lanka. The majority of seabirds reported are migrants; winter, summer or passage migrants and they reside for one season of the year, either partially or almost exclusively at sea but mainly in shallow coastal waters. Compared to the numbers reported of terrestrial birds, seabirds are far less in numbers in the seas around Sri Lanka. The species reported in offshore areas are Brown-headed gull

(*Chroicocephalus brunnicephalus*), Common Tern (*Sterna hirundo*), Caspian gull (*Larus cachinnans*) Intermediate egret, and Median egret (*Mesophoyx intermedia*). All these species are waders and not divers. The most highlighting feature is that no seabird has been observed in the high seas around Sri Lanka.

The potential impact of fisheries on seabirds is basically indirect. No seabird has been seen interacting with longline either when line is setting or line hauling. Indirect effects have not been studied in depth. It is possible that the tropical seabirds may be indirectly affected through over exploitation of surface schools of pelagic fishery resources.

Introduction

Incidental catch of seabirds in longline fisheries has been identified as one of the world's most serious threats to the long-term viability of many populations of pelagic seabirds (Brothers *et al.*1999; Gilman 2001; Gilman *et al*., 2005). Being vulnerable to unsustainable levels of mortality, the populations of pelagic seabird species can decline over short temporal scale and are slow to recover from large declines due to their K-selected life-history strategy. This problem is primarily known in the southern hemisphere where species of albatrosses and large petrels are at risk of extinction, resulting in a permanent alteration to marine ecosystem functioning (Inchausti and Weimerskirch, 2001; Kitchell, *et. al*., 2004; Abraham and Thompson, 2012).

Pelagic seabirds are highly migratory, and frequently move in and between national jurisdictions and thereby interact with longline vessels on the high seas. They are attracted to baited longline hooks and discharged offal, and can drown if they swallow the hooks or become snagged. The extensive foraging distributions of pelagic seabirds frequently overlap with longline fisheries. The resulting risk to seabirds from fishery interactions has led to the establishment of several international conservation agreements.

However, although longlining is growing in the Indian Ocean, little information is available about seabird mortality and threats to populations of scavenging seabirds. There is international pressure to develop technical solutions for reducing this incidental mortality

and to have these solutions adopted by the fishing industry. IOTC has begun addressing seabird bycatch, approving resolutions regarding national action plans, data gathering, a zero-bycatch goal, and use of mitigating technology and fishing practices.

Conservation issues

There is no information recorded on seabird interaction with any fisheries in the present data collection system. Lack of understanding and not paying much attention may under represent the seabird incidental catch in the fisheries database.

Aims and objectives of the study

In comply with the Resolution 12/06 on reducing the incidental bycatch of seabirds in longline fisheries which will enter into force on 1 July 2014, Sri Lanka has initiated this study to assess the likely impacts of local fisheries on seabirds.

Objectives of the study were:

- Identify seabirds in coastal and offshore waters of Sri Lanka
- Quantify the impacts on seabird due to longlining and other fisheries operating in coastal and offshore waters
- Identify areas where conservation actions are most needed

Methodology

Sri Lanka has a well-established marine fisheries sector, and fishing activities are carried out both in coastal and offshore waters within the EEZ, and some fishing in high seas employing multiple fishing gear where gillnet and longline fisheries along or in combination are more pronounced (Hewapathirana and Maldeniya, 2013).

A large number of studies in Indian Ocean have highlighted that incidental catches of pelagic large seabirds in fisheries might pose a considerable risk for the conservation of their populations (Inchausti and Weimerskirch, 2001). It showed that commercial longline

and (to a lesser extent) gillnets and trawling caused incidental catches of seabirds. Nevertheless, reliable data on seabird interaction with local fisheries is very limited and need to be developed if meaningful conclusions are to be arrived at. This study constitutes a first attempt at the evaluation of bycatch of seabirds in the marine fisheries of Sri Lanka.

Data for the present study were basically collected from primary sources during the period March 2013 to June 2014. Data were obtained from;

1. Research cruises
2. Onboard observer records and tracking
3. Fisheries monitoring surveys and interviews with fishermen

Onboard observation and tracking records of seabirds were made during the two cruise; Dr. Fridtjof Nansen (22nd October to 3rd November 2013) and RV Roger Revelle (10th November to 27th November; 28th November to 13th December and 16th December to 25th December 2013) in Sri Lankan Coastal waters and Bay of Bengal in Indian Ocean.

Studying of fisheries interaction with seabirds was confined only to longline and gillnets in the present study. There is no national observer program to collect fisheries data onboard of multiday fisheries. An observer was placed onboard to record the observations. Observations on board multiday boats were carried out from April 2013 to May 2014, covering a total of 7 fishing trips (Table 1). The main target was to study sea turtle interaction in fisheries and at the same time they too studied the seabird interaction. Of the eight onboard fishing trips five were conducted on tuna longline fishing in southern sea and two were made on gillnet and longline fishing (Table 1).

Table 1: Observer log

Month	Port	Fishing gear	Trip duration	Fishing days	Fishing area
April/May	Negombo	Longline	11	8	South
October	Mirissa	Gillnet +	23	11	Southeast

		Longline			
November/December	Negombo	Longline	9	5	Southeast
January	Negombo	Gillnet + Longline	19	9	Southwest
February	Negombo	Longline	13	7	Northwest
March	Negombo	Longline	17	8	Southeast
April/May	Negombo	Longline	19	11	Southeast

Observers were trained to collect data and identify sea turtles as well as seabirds. They used GPS units, Binoculars, photographic and other equipment. The observer recorded the following information from each set - date and time at deployment, geographic position at the beginning and at the end of deployment, speed of deployment, date and time at retrieval, geographic position at the beginning and at the end of retrieving, speed of retrieving, mainline length, number of hooks deployed, hook type, hook material, distance between gang-ions, number of floaters, distance between floaters, bait type, total capture of fish.

During the study the onboard observer is given a binocular of (10x50x) magnification, stopwatch, camera and a field guide to identify seabirds. The observer has been instructed to study fishing operation, bycatch, especially sea turtles and seabirds catch of gillnets and longline fisheries targeting large tuna in the offshore waters and also tracking of seabirds during the fishing operation and cruising. However, onboard observation and tracking of seabirds in coastal fisheries were somewhat reasonably covered (96 trips) collectively by the field officials of the National Aquatic Resources Research and Development Agency (NARA), the Department of Fisheries and Aquatic Resources (DFAR) and the university undergraduate students. Since observing from a boat is impossible in rough weather condition during monsoonal months all onboard observation studies were made during non-monsoonal period; October to April in the west and south coast while in the east coast in May to September. In the present study the onboard observations were made covering mainly west and south coast as seabirds are much seen in these areas (De Silva, 2011). In

addition, shore based observations were also made during the calm season where seabirds come close to the shore.

Data of the field monitoring were collected through a questionnaire-based survey, which was conducted in collaboration with the DFAR at selected landing sites; Dodanduwa-Galle, Negombo-wellaweediya, Chilaw and Kandakuliya-Kalpitiya. Over 300 fishers engaged in gillnet and longline fisheries in both coastal and offshore fisheries were interviewed during the period of March 2013 to June 2014. The collected fishery data included fishery characteristics, types of fishing gear used, fishing months per gear type, fishing areas targeted, average fishing days per month, and average daily fishing effort (number of hooks per day for longline, and number of net pieces deployed for nets). The data related to seabird bycatch included main bycatch seasons, marine areas targeted and average annual number of seabirds caught or encountered per type of fishing gear. The questions relating to species on specific incidental capture were supported by images of the birds to facilitate correct identification of the species by the interviewees (Appendix I).

Results

Seabirds spend most of its time at sea. They have become highly adapted to life on the sea. Seabirds gather their food from the sea either by themselves or in large feeding flocks. Seabirds reported in Sri Lankan waters are in two main categories;

- rest, roost or forging on rolling waves
- rest or roost on land or nearby trees

Seabirds who rest or forage on rolling waves are purely oceanic species whereas the other are coastal seabirds which live in the coastal waters, lagoons, estuaries, mudflats, salt marshes and sometimes inland waters. When seabirds gather on remote islands and rocky outcroppings, they form a colony. During this study we were able to study seabirds both on the open sea and on their colonies.

Seabirds encountered in research cruises

The two cruises that NARA officials participated had given the unique opportunity to study

seabird interaction with trawl fishing and also to track the seabirds in the survey area. There had not been any sighting of any seabird during the time of fishing or at the time of hauling the net. During cruising they have encountered two species of seabirds; *Mesophoyx intermedia* (intermediate egret, median egret) and *Otus lettia* (Collared scops owl) Figure 1.

Mesophoyx intermedia are mainly found around shallow inland freshwater areas with abundant emergent aquatic vegetation. This species occurs less often in coastal habitats, but may sometimes be found around mudflats, tidal estuaries, coastal lagoons, salt marshes, and tidal streams and rivers, and often roosts in mangroves. They are active during the day and forage in water less than eight centimeters deep for a variety of prey, including fish, frogs, crustaceans and aquatic insects. Intermediate Egret is resident in most parts of Africa, south of the Sahara, and across tropical southern Asia to Australia.

Otus lettia is a resident breeder in south Asia from northern Pakistan, northern India and the Himalayas east to south China. It is partially migratory, with some birds wintering in India, Sri Lanka and Malaysia. They feed mainly on insects.

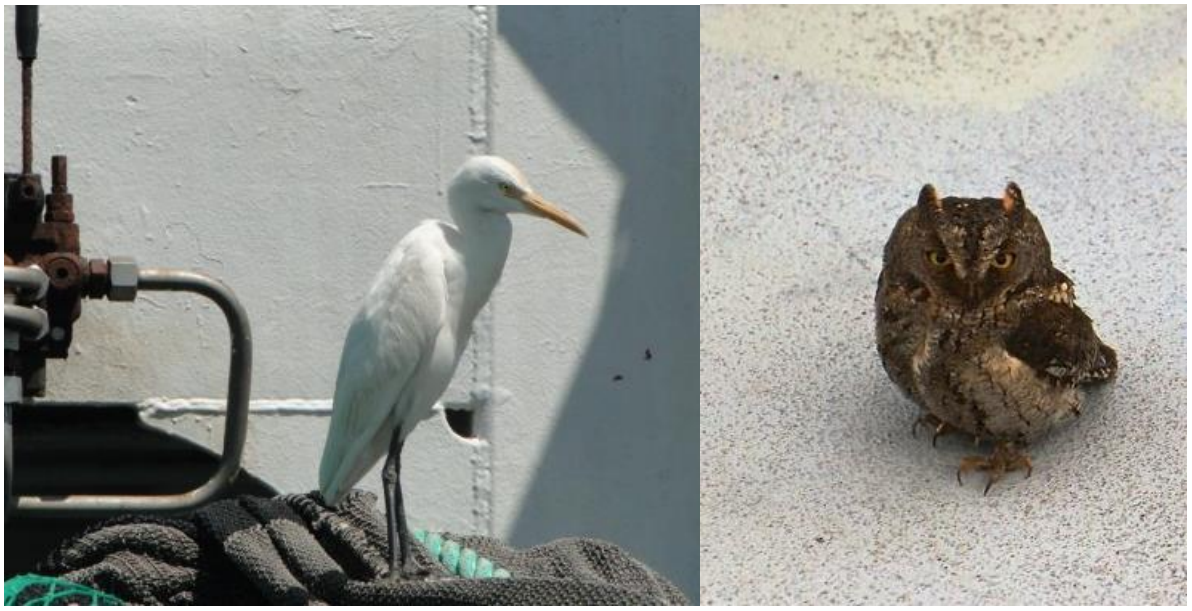

Figure 1: *Mesophoyx intermedia* and *Otus lettia*

Onboard observation and tracking

1. Coastal seas

A total of 21 seabirds were identified from onboard observation in the western and southern coastal seas (Table 2) and in five observations the species was not identified. These species were observed only a few kilometers out at sea. Majority of species recorded are purely oceanic either winter visitors from northern regions or summer visitors. A few are passage migrants. However, the most visible birds are the various species of terns and gulls. Although many rare seabirds are spotted from small boats bouncing on the waves or viewed distantly from wind-blown headlands, these observations were not ideal, descriptions often ambiguous, and photos not clear enough.

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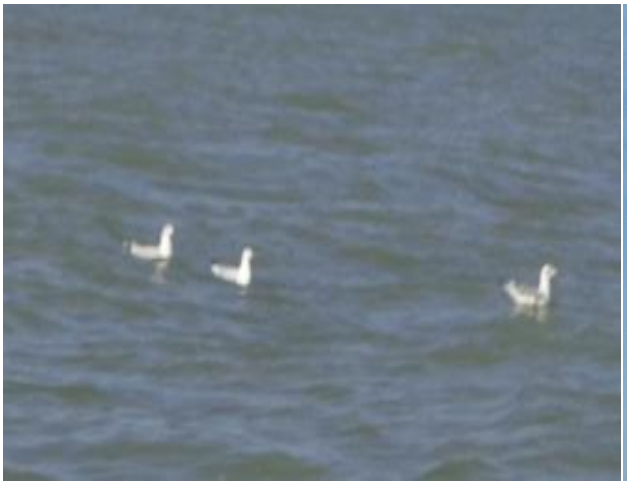

Larus cachinnans

Sterna hirundo

Chroicocephalus brunnicephalus

Table 2: Seabirds reported from coastal seas

Species	Common name	Location
Larus brunnicephalus	Brown-headed gull	Dodanduwa- Southwest coast
Sterna nilotica	Gull-billed tern	Kalpitiya-Northwest coast
Sterna caspia	Caspian tern	Ambalangoda – Southwest coast
Chliodonias hybridus	Whiskered tern	Off Colombo
Sterna anaethetus	Bridled tern	Off Colombo
Sterna albifrons	Little tern	Dodanduwa, Galle, Panadura- Southwest
Sterna bengalensis	Lesser crested tern	Off Gallle
Sterna hirundo	Common tern	Off Negombo, Chilaw
Haliastur indus	Brahminy kite	Off Kalpitiya, Chiaw, Negombo
Sterna dougallii	Roseate tern	C hilaw, Negombo
Larus brunnicephalus	Brown-headed gull	Off Colombo
Charadrius alexandrinus	Kentish plover	Off Colombo
Anous stolidus	Brown noddy	Kalpitiya
Sula leucogaster	Brown boody	Off Negombo, Kalpitiya
Phaethon aetherus	Red-billed tropicbird	Off Galle
Chlidonias hybridus	Whiskered tern	Off Panadura
Sterna bergii	Great crested tern	Off Galle
Daption capense	Cape petrel	Off Colombo
Puffinus pacificus	Wedge-tailed shearwater	Off olombo
Larus heuglini	Heuglin's gull	Negombo
Artamus fuscus	Ashy wood swallow-shrike	Off Galle

A major seabird colony was reported three kilometers off Ambalangoda called "Gedawana Gala". Two species of terns; *Sterna albifrons* (Batulihini or Little tern) and *Sterna bergii* (Kondalihini or Great crested tern) are colonized cracks and gullies in the rock.

2. Offshore

Observation of seabirds was only limited to coastal waters and when the boat proceeded beyond 10-12 kilometers from the shore there were no sightings of seabird flocks on the water or flying.. Large flocks of *Chlidonias hybridus* were reported off Colombo harbor and *Sterna anaethetus* off Panadura. One observation of *Cantharacta lonnbergi* was reported off Colombo and one observation of *Sterna capsia* was reported from Galle. There were two unidentified species both reported off Colombo and one is believed to be *Buleria fallax*.

3. Tracking onshore

During the study period 18 species were identified through tracking (Appendix Table 1). They are mostly coastal inhabiting seabirds or facultative seabirds.

Seabirds Interaction with longline fishery

Longlining is a passive type of fishing technique making use of lines with baited hooks as fishing gear. In the marine fisheries two types of longlines are used; pelagic longline and bottom longline. Pelagic longline gear is intended to fish at a range of depths in the water column. The use of pelagic longline is basically for tuna and tuna like species. Tuna longline operate both in coastal and offshore waters. Coastal operation of tuna longline is quite seasonal and confined to limited areas; Kandakuliya-Thalawila (northwest coast) and Trincomalee (east coast) and conduct with small 19-20 ft FRP/OBM boats. Offshore and high sea operation is done with Multiday inboard motor boats of 35-50 ft of length.

The mainline is the basic part of longline gear and it is made up of units or baskets. The thickness of the monofilament mainline generally is 250 mm, which is made from

polyamide. Branch lines are connected to the mainline at appropriate intervals. Each basket consist 5-7 branch-lines are fixed with curb hooks. Branch-lines are monofilament of 170-180 mm thickness. Branch line is about 40-45 meter in length in offshore gear and 25-30 meters in coastal gear. Circle hooks of No. 5 are basically used both in coastal and offshore operation. Mainline is suspended using monofilament float-line of 10-30 meter in length and 170-180 mm in thickness. Small boats operating in coastal waters carry 150-200 hooks while in offshore multiday boats carry 300-400 hooks. Boats equipped with line haulers carry 500-750 hooks. Generally branch lines are stored separately and attached to the main line while casting the line, each hook being baited just before leaving the vessel to the fishing ground. Sardines and flying fish are used as bait in coastal longlining while in offshore *Decapterus sp*., squids, milkfish and trench sardine are used as bait. In the offshore waters generally longline is shot before dawn and hauled with the sunrise.

The observer report revealed that manual shooting of 100 baited hook takes about 12-15 minutes in calm sea day in offshore water while 9-11 minutes in coastal waters. It is quicker with the line hauler and it takes 10-12 minutes. Hauling of line takes more time depending on the catch on average to haul one branch line it takes 12 seconds with the line hauler.

Bottom longline is targeting demersal fish and it operates in shallow coastal waters of < 50 meters using FRP/OBM boats. The gear rigging is somewhat similar to pelagic longline. Mainline is monofilament of 150-180 mm thickness or polypropylene multifilament rope and branch lines are also monofilament of 180-200 mm thickness attached to the mainline. Short branch lines of 1-2meters and hooks are directly attached to the main line. Size of the hook and the type of the hook varied with the target species. For grouper, the circle hooks of no. 6-7 is used and for other demersal No. 7-10 circle or J hooks are used. Cut pieces of sardines are generally used as bait. Number of hooks used depends on the target group and generally the boat would carry 300-500 hooks. Bottom longline are shot before dawn and hauled with the sunrise. The time taken to shoot baited 100 hooks is 7-8 minutes.

Incidental seabird interactions are not documented by observers both in coastal and offshore longline operations. However, in one occasion, a seabird has come close to the boat when dressing the fish catch (gutting tuna) and it was identified as *Catharacta lonnbergi* or *Stercorarius pomarinus*.

Interaction with gillnet fishery

Drift gillnets is the predominant fishery which is mainly responsible for capturing of pelagic fish in the coastal and offshore waters. Large mesh drift gillnets are employed in capturing large pelagic fish such as tuna and tuna like species especially in offshore waters within EEZ. Small mesh gillnets are employed in capturing small pelagic fish such as sardines, herrings, scads etc., in the coastal waters. Fishing is generally made at the depths of 20-40 meter depth range.

Large mesh gillnets are generally made from 6 inches mesh of 24 ply multifilament nylon net. It is rigged in 100 meters length panel or piece, and the net is generally consisting about 20-25 such panels. Generally a net is deployed in 2-2.5 m depth from the surface. Nets are shot during the sunset and haul before dawn. Gear operation is generally manually but limited number of multiday boats especially the large boats of > 40 feet are equipped with gets haulers.

Small mesh gillnets are rigged with a range of mesh size depending on the target species. The most commonly used mesh size is 1-1.5 inches mesh of 2-4 ply. Each panel is about 20 meters and10-12 panels are employed in fishing. Fishing is conducted before dawn and hauled with the sunrise. These nets are suspended about 0.5 -1.0 meter below the surface when fishing.

No seabird entanglement or striking was reported by observers either in coastal or offshore fishing with gillnets. They even never reported any bird attraction while hauling the net.

Experience and observation of fishermen

Interviews with offshore fishers; gillnet and longline fishers enabled obtaining information on the occurrence of seabird interactions. Responses were consistent that seabird interactions in these fisheries are extremely rare event, and few respondents recalled the memories of seen seabirds occasionally roaming around their boat when they were fishing in high seas. According to their description they were in solitary. They are dark brown in color with a long, over one meter wingspan. The fishermen call them "Ali Bassa" meaning "high sea owl" or "Kelawal Bassa" meaning that the seabirds are associated with yellowfin tuna schools. This shows that fishermen are quite aware that flocks of seabirds are accompanying surface tuna schools in high seas. Two skippers of longline boats reported that seabirds occasionally come close to the boat when removing bait from hooks and forage on discarded bait and offal, but never observed a seabird being captured. However, none of the longline fishermen in coastal fisheries were aware of such birds and never had any experience of seabird interaction in fisheries.

The presence of seabirds brings mixed results to coastal fishermen. Fishermen, especially beach seine fishermen have put to use their knowledge of seabird behavior to gain information about the occurrence of fish schools. They guide the fishermen to locate baitfish. In return, seabirds have also learned to take advantage of the fishermen's ability to group and haul fish up to the water's surface allowing for a convenient meal. During the season when migrant seabirds come in large numbers, the fish catch get reduced due to mass consumption.

Discussion and conclusion

Being an island a considerable number of seabirds are reported in the seas around Sri Lanka. The identified list has 54 species (Kotagama and De Silva, 2006). Out of them only 8 species are breeding residents, 13 winter visitors and 6 are summer visitors and majority of them are coming from northern temperate areas. Three species are passage migrants and 8 are irregular migrants and status is unknown for 22 species.

De Silva (2001) reported a list of oceanic seabirds which occasionally visit to feed in the seas of Sri Lanka. They are solitary. Among them several species of petrels; White-headed Petrel *Pterodroma lessonii,* Soft-plumaged Petrel *P. mollis,* Barau's Petrel *P. baraui,* Wilson's Storm-petrel *Oceanites oceanicus,* Black-bellied Storm-petrel *Fregetta tropica,* Swinhoe's Storm-petrel *Oceandroma monorhis,* and shearwaters; Flesh-footed Shearwater *Puffinus carneipes,* Red-billed Tropicbird *Phaethon aethereus,* Audubon's Shearwater *P. lhermieneri.,* Streaked Shearwater *Calonectris leucomelas.* Since they are visitors and not forming large flocks and also stay scattered over a huge area the effort to study their interaction with fisheries require extensive sea observations and make them difficult to study.

Majority of seabirds reported have largely lost their diving abilities and are confined to feed near or above the water surface. Subsurface predators commonly glide to get the prey because the air-water interface acts as a boundary beyond which most prey cannot escape.

The present study indicates that fishermen especially longline fishermen are somewhat aware of the seabirds but gillnetters have no concerns. Gillnet used in Sri Lanka are multifilament nylon, which are usually highly visible to seabirds and have less potential of becoming bycatch than in less visible monofilament nets. Fishing time of gillnetting both coastal and offshore may have large influence on having less interaction with seabirds. Further, the species and number of individuals caught by gillnets are also affected by factors such as mesh size, ply, setting depth, soaking time, water transparency, weather conditions and setting location in relation to seabird abundance. Traditional knowledge made them to adopt their own migratory measures. Fishermen avoid foraging areas of seabirds as they get low returns.

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Rex I De Silva, Seabird Watch, 31 Dampe, Madapatha 10306, Sri Lanka.

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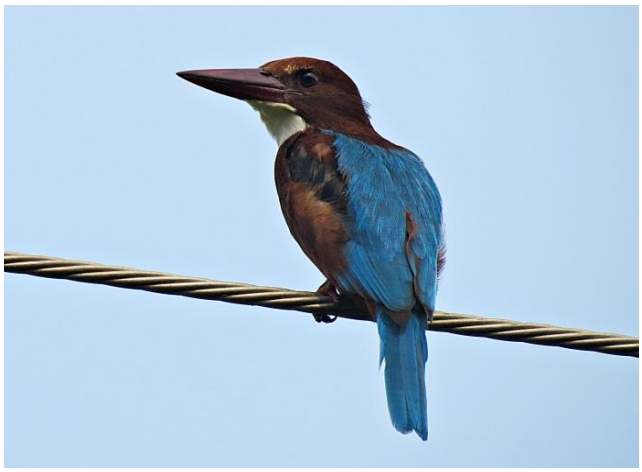
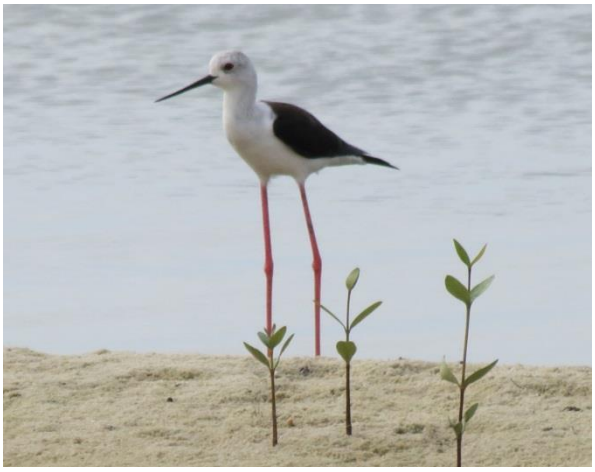
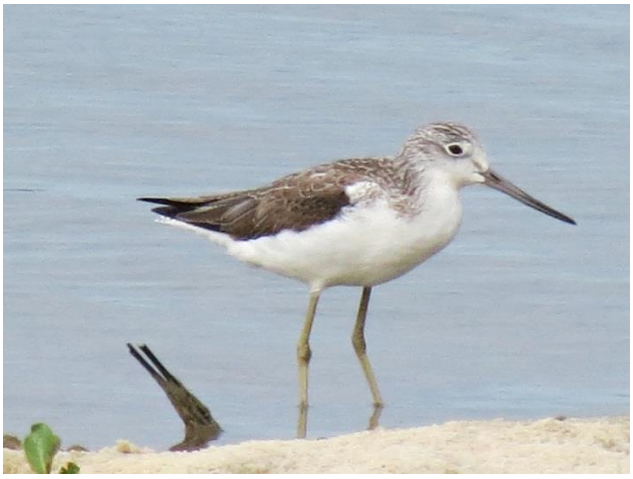
Appendix Table 1: Seabirds observed onshore



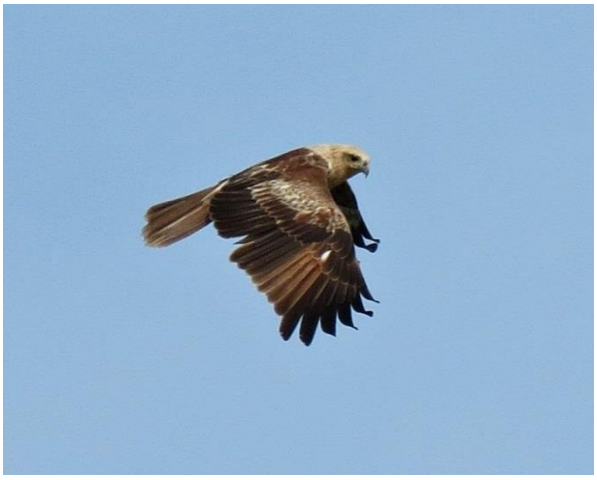
Halcyon smyrnensis



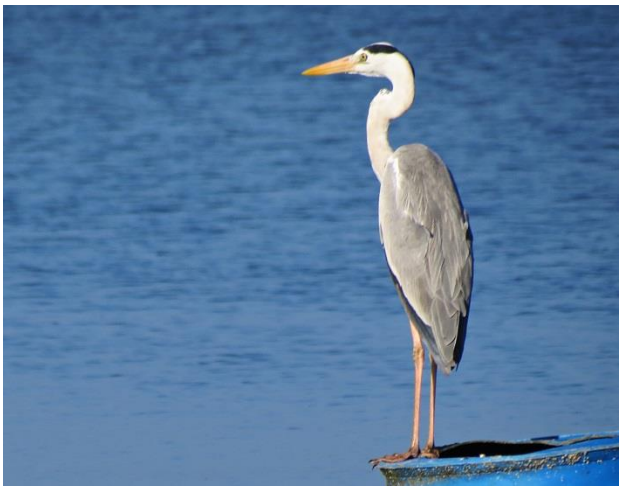
Himantopus himantopus



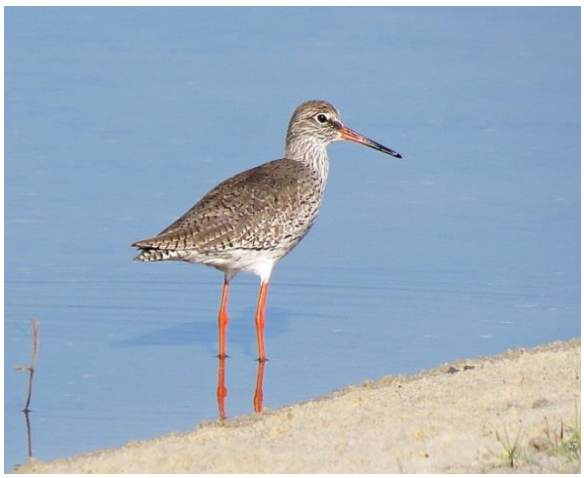
Tringa nebularia



Ichthyophaga ichthyaetus



Ardea cinerea

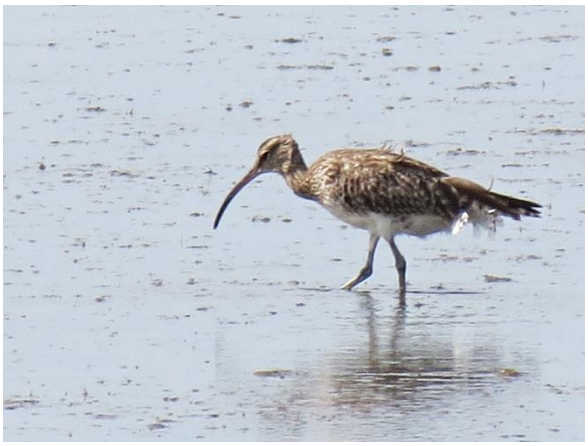


Tringa totanus

Ceryle rudis

Tringa hypoleucos

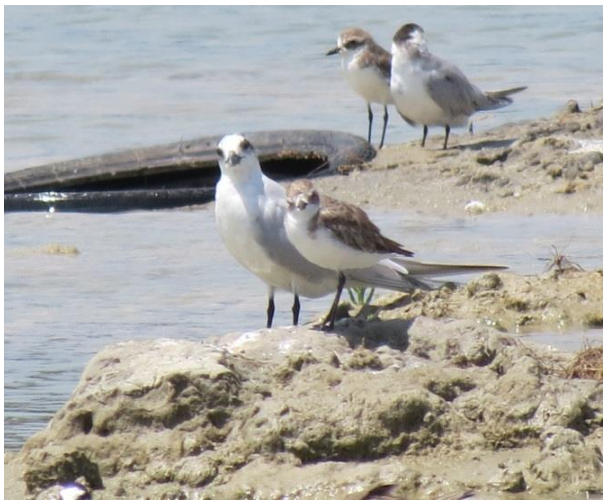
Arenaria interpres

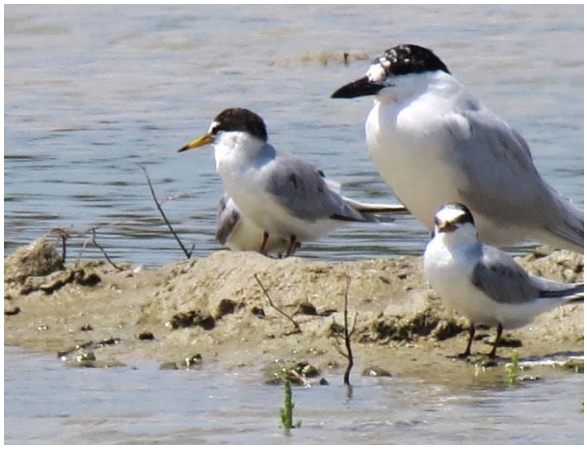


Numenius phaeopus

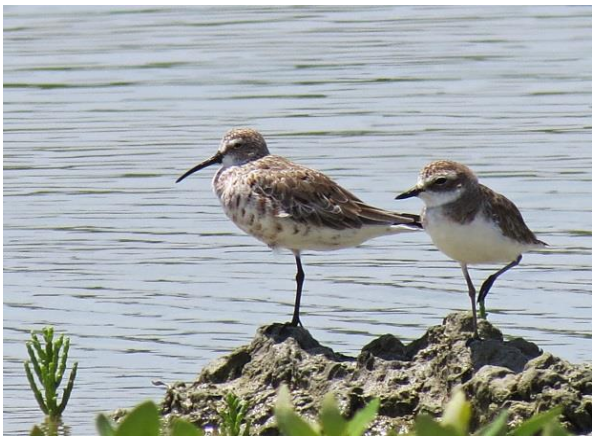
Phalacrocorax niger

Charadrius mongolus

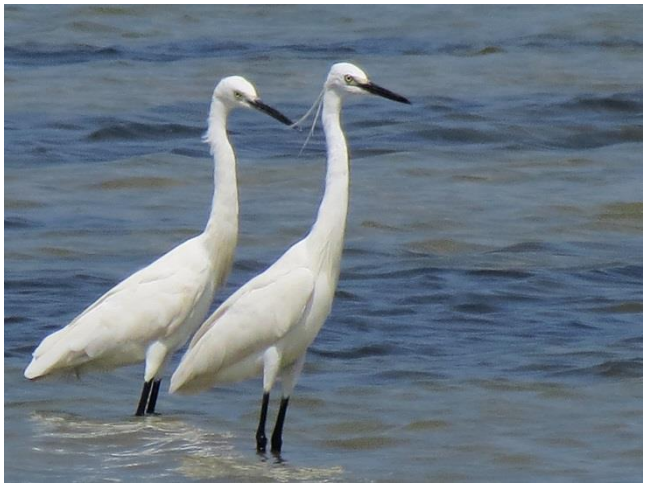




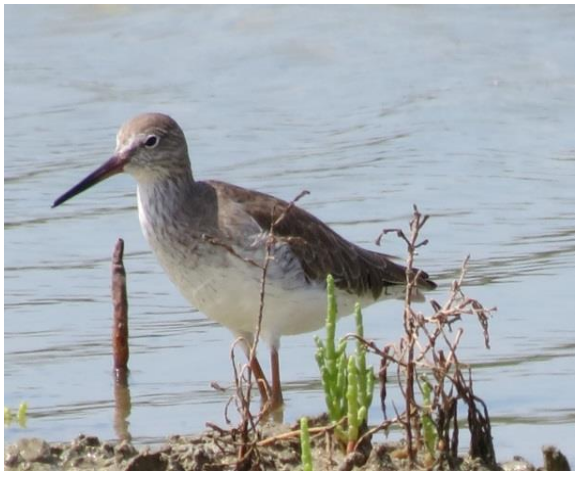
Sterna dougallii



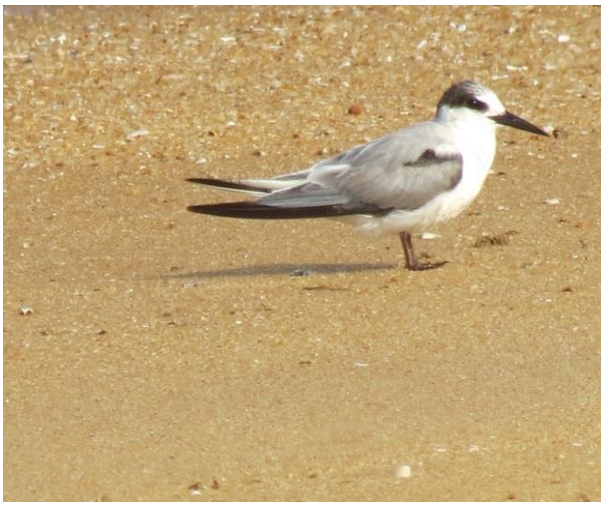
Calidris ferruginea



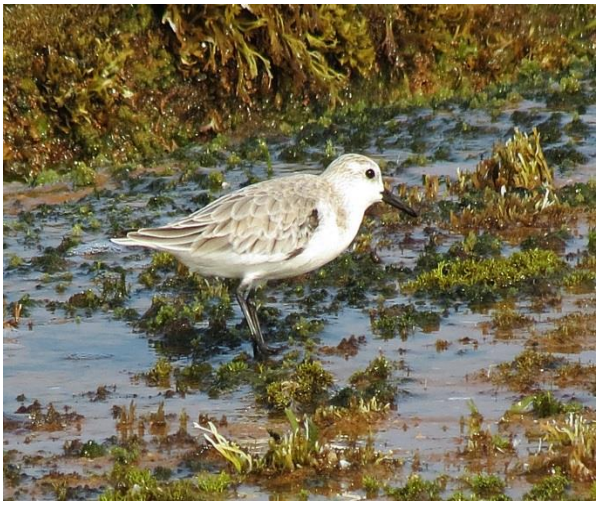
Egretta garzetta



Calidris fuscicollis



Sterna sumatrana



Limicola falcinellus