Seabird Ecology

seabird - definition
birds that spend most of their lives at sea, coming ashore only during breeding season for purpose of reproduction

why make the distinction?
a variety in adaptations and specialization's to a **marine** way of life - most of world's surface is water, yet few birds have adapted to it, because it is such a harsh environment - the distinction is **ecological**

Seabirds include:

Penguins - Spheniscidae 18 spp.
Albatrosses - Diomedeidae 14 spp.
Shearwaters - **Procellariidae** 61 spp.
Storm-Petrels - **Hydrobatidae** 19 spp.
Diving Petrels - Pelecanoididae 4 spp.
Tropicbirds - Phaethontidae 3 spp.
Boobies and Gannets - **Sulidae** 9 spp.
Frigatebirds - Fregatidae 5 spp.
(Cormorants - **Phalacrocoracidae**) <10 spp.
Skuas and Jaegers - **Laridae** / Stercorariidae 6 spp.
(Gulls and terns - **Laridae**) <20 spp.
Auks - **Alcidae** 21 spp.

Total: **190** spp. (2% of world's bird species)

Marine ecology from a seabird's perspective

oceans are like deserts - mostly barren of food, but with highly productive oases

tropical and subtropical waters (equatorial regions)

- surface water extremely low in dissolved nutrients (nitrate and phosphate) necessary for the growth of phytoplankton

- due to stratification of water and lack of mixing (lack of wind and current relative to boreal and austral regions)

so - without phytoplankton, there is little food available

tropical and subtropical waters, continued

Exceptions to lack of food in tropics

geographical exception: west coasts of continents - upwelling zones are highly productive (e.g., Peru, Namibia, west Africa)

other exception - wide ranging schooling predatory fish (tuna spp.) regularly concentrate prey at surface even in 'dead zones' - ephemeral food resource

arctic and Antarctic waters

- surface waters have lots of dissolved nutrients and sunlight (during summer), so phytoplankton productivity is high - fish and zooplankton are seasonally abundant

everywhere - the mean (average) density of prey is far lower than can be profitably exploited by seabirds, so foraging seabirds must use oceanographic or other features that concentrate prey to 10x or more mean density:

- tidal pumps (regular tidal upwelling)

- convergence zones - where currents meet

- surface microhabitat - Langmuir cells (wind upwelling)

- fish (salmon, tuna et c.) schools driving prey

- challenge: concentrations of prey are often far from land and consequently isolated from breeding areas

Seabirds - Basic Ecology and Life History traits

feed on marine animals (i.e., all are predators
- chiefly fish, crustacea (shrimp, Euphausiids, copepods) and squid

- pelagic schooling fish/planktonic crustacea/benthic trichotomy is an important theme

- a few species are bird predators (skuas, jaegers, gulls, frigate)

they feed far from their breeding sites - inevitable

traits of seabirds

small clutch size (usually one, sometimes two, rarely more) - hard to feed more than a single chick

long life span - many breeding seasons are required for adults to replace themselves

monogamous, both sexes contribute to parental care (usually virtually equally) - care of two parents is required

colonial nesters (mostly) - nesting habitat is usually limited (islands)

traits of seabirds, continued

vulnerable to terrestrial predators - seabirds are morphologically adapted to life at sea rather than for life on land

salt gland for seawater drinking, oil gland for waterproofing plumage

plumage tends to be dull, but some species have elaborate facial ornaments

Seabirds - Foraging modes

pursuit diving
- rapid underwater pursuit (foot or wing-propelled)
- penguins, diving petrels, some small shearwaters, auks
- mostly at high latitudes

plunge diving
- using gravity for rapid plunges from the air after prey with a few metres of the sea surface.
- gannets, tropicbirds, some shearwaters, gulls and terns

Foraging modes, continued

surface picking (while flying)
- albatrosses, some shearwaters, frigatebirds, storm-petrels, gulls and terns (many tropical seabirds - they don't like to get wet!)

surface picking (while resting on surface)
- albatrosses, some shearwaters, storm-petrels, gulls

Foraging modes, continued

flying fish/flying squid specialists
- seize prey in mid-air as they attempt to escape predatory fish (usually tunas)
- one booby sp., terns
- tropical seabirds only: e.g., Sooty Tern, Brown Noddy

Kleptoparasitism
- stealing food from other seabirds
- frigatebirds, skuas and jaegers, gulls

Foraging modes, continued

Scavenging
- eating dead things
- albatrosses, shearwaters, storm-petrels, skuas and jaegers, gulls, frigatebirds

predators
- some shearwaters, skuas and jaegers, gulls

Seabird breeding biology

Nest-site selection

- two priorities: secure from predators, close to food sources

Kinds of nest sites

burrows - most common form of nest site (because of large number of shearwater and petrel species, which almost invariably choose burrows) - not in large species, gulls or terns

rock crevices - similar to burrows except not constructed by the birds themselves - storm-petrels, auklets (Alcidae)

Kinds of nest sites, continued

cliff ledges - safe! - used by murres and some gulls

tree nests
- tropical species: boobies, frigatebirds, terns
- Marbled Murrelets

surface scrape
- used by remaining species (with absence of mammalian predators a prerequisite)

Incubation - invariably shared by pair members

Chick-rearing - invariably shared by pair members

Chick development - flexible only in the Alcidae

Precocial
- chicks leave nest soon (2 days) after hatching, then are cared for at sea by both parents - in alcids only: murrelets of genus *Synthliboramphus* only

Intermediate
- chicks leave nests when 'half-grown', are cared for by one parent at sea (the male) - alcids only: murres and Razorbill

Chick development, continued

semi-precocial - chicks remain at nest until fully developed, then are abandoned by parents - most alcids, all other species

most seabirds have semi-precocial young

Seabird breeding biology, continued

- the duration of incubation and chick rearing periods is highly variable

- the longest incubation periods occur in the albatrosses (c. 80 days)

- the longest chick rearing periods occur in the penguins (Emperor Penguin > 1 year!)

Seabird conservation

Seabirds vulnerable

nesting on oceanic islands, which are being rapidly developed and changed - e.g., Carribean, tropical Pacific

-95% of tropical Pacific islands formerly occupied by breeding seabirds are now unavailable due to humans

-entire species restricted to a single breeding colony or small area where entire species could be wiped out by one catastrophy e.g., Cahow (Bermuda Petrel)

Seabirds vulnerable

- vulnerable to introduced predators

- specialize on concentrated prey which may also be sought after by commercial fishers (e.g., Peruvian anchovies, Shetland sandeels, capelin) - fisheries worldwide are fish down through food chain and are increasingly targeting species that seabirds eat (e.g., Capelin in Newfoundland)

seabirds resistant

- tend to nest on small remote islands where few humans would want to live (e.g., Funk Island, NF and especially remote islands in antarctic and sub-antarctic; both with strict reserves)

seabirds resistant

colonial habits of many species make it easy to design refuges (e.g., 90% of Newfoundland seabirds are protected because they nest on a few islands that are designated as ecological reserves)

are long-lived - confers resistance to short term perturbations

Oil spills in the ocean

3.2 billion litres of oil are spilled or dumped into the world's oceans each year

oil spill problem for pursuit-diving species (particularly auks) and other species that spend lots of time in the water

two effects - catastrophic and chronic

catastrophic spills

- e.g., Exxon Valdez oil spill in Prince William Sound Alaska in 1989, 36,400 tonnes of oil spilled, 350,000 - 390,000 seabirds killed, mostly murres

chronic spills
- e.g., dozens or even hundreds of small releases of oil from vessels transiting Newfoundland waters - these kill many **hundreds of thousands** of birds annually, but receive less attention (mostly due to deliberate dumping of waste oil) – first conviction under MBTA March 2001

effects of oil on birds
- destroys waterproofing on plumage, resulting in loss of insulation from cold and consequently, hypothermia
- poisoning - components of the oil are absorbed and damage liver, kidneys and reproductive organs

solutions?

'rehabilitation' i.e., cleaning of birds after a spill

- frequently put forward as a solution - relates to post-spill hand-wringing
- costly e.g., $41 million US spent to clean 400 seabirds after Exxon spill
- of dubious value e.g., study of 127 oiled Common Murres that were 'rehabilitated' and released - post release life expectancy was 9.6 days, only 4 survived more that 5 months and 2 were thought to have survived for a year
- conclusion - 'rehabilitation' does not help the birds involved or their populations

legislation and enforcement of anti-dumping laws - slow in coming, lax in application

Commercial fishing - direct mortality
by-catch in fishing gear - especially long-line fisheries
- albatrosses and large petrels are threatened

long line fishing - deploys thousands of baited hooks shot out of fishing vessel - hungry birds grab bait, are hooked and drown

the scale of the problem:
- 12 of 14 albatross species are affected
-44,000 albatrosses killed by tuna long-line fisheries each year

-predicted extinction times from modeling of current kill levels are less than 25 years for several albatross species