

Literature Review - Lighting adjustments to mitigate against deck strikes/ vessel impacts - MIT2019-03

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Image: Whitehead, 2018



OVERVIEW OF
SEABIRD ATTRACTION
TO ALAN

Seabirds are attracted to and disorientated by artificial light at night (ALAN) in both terrestrial and marine environments

Birds become confused or are blinded by lights which can result in collisions with structures causing injury or death

Exhaustion caused by the continuous circling of the light source and are unable to get airborne again

At risk of predation, vehicles (urban), dehydration, starvation, hypothermia if waterlogged or oiled (marine)

- Much of the literature focussed on artificial light impacts in urban environment with little information on deck-strike in scientific literature
 - Urban grounding recorded around the world e.g. NZ, Australia, Hawaii, Reunion Island, Canary Islands, Portugal, UK, Chile
- Marine environment deck-strike examples from USA, NZ, Australia, Alaska, Greenland, Southern Ocean including Tristan archipelago and Gough Island.

SOME SPECIES MORE
VULNERABLE THAN
OTHERS

Gadfly petrels, shearwaters and storm petrels (order *Procellariiformes*) are disproportionately attracted to artificial light at night.

At least 56 species are negatively impacted globally (Rodríguez, Holmes, et al., 2017), an increase on the 21 known species in the 1980's (reviewed in Reed et al. (1985).

Nocturnally active, vulnerable to light attraction during migration, foraging or when returning to colonies .



SOME AGE-CLASSES
MORE VULNERABLE
THAN OTHERS

Fledgling petrels and shearwaters are particularly vulnerable to land-based artificial lighting on their maiden flight
Frequently make up >90% of grounded birds



Photos: Matt Rayner

Why? – three hypotheses

Bioluminescent prey

Navigate using the moon and stars

Light and food association through burrow

THREATENED
STATUS OF MANY
SEABIRDS

Artificial light at night is increasing globally (Kyba et al., 2017) and light-induced mortality is thought to be contributing to the decline of several petrel and shearwater species.

Especially concerning as seabirds are the most threatened group of birds in the world already.

E.g. Of the 2,348 birds grounded by lights on Reunion Island between January 1996 and December 1999

70% were endangered Barau's petrels
(*Pterodroma barau*)

29% were non-threatened Audubon's shearwaters
(*Puffinus lherminieri bailloni*)

several were endangered Mascarene petrels
(*Pseudobulweria aterrima*)

DECK STRIKES VARY
WITH DIFFERENT
FISHING METHODS AND
FISHERIES

Trawlers most commonly mentioned
fishing method in the literature

Use lights during night setting

Invertebrate fisheries (e.g. squid, crabs)
most commonly mentioned in deck-
strike literature

Use lights to attract target species

All vessels use deck lights for crew
safety

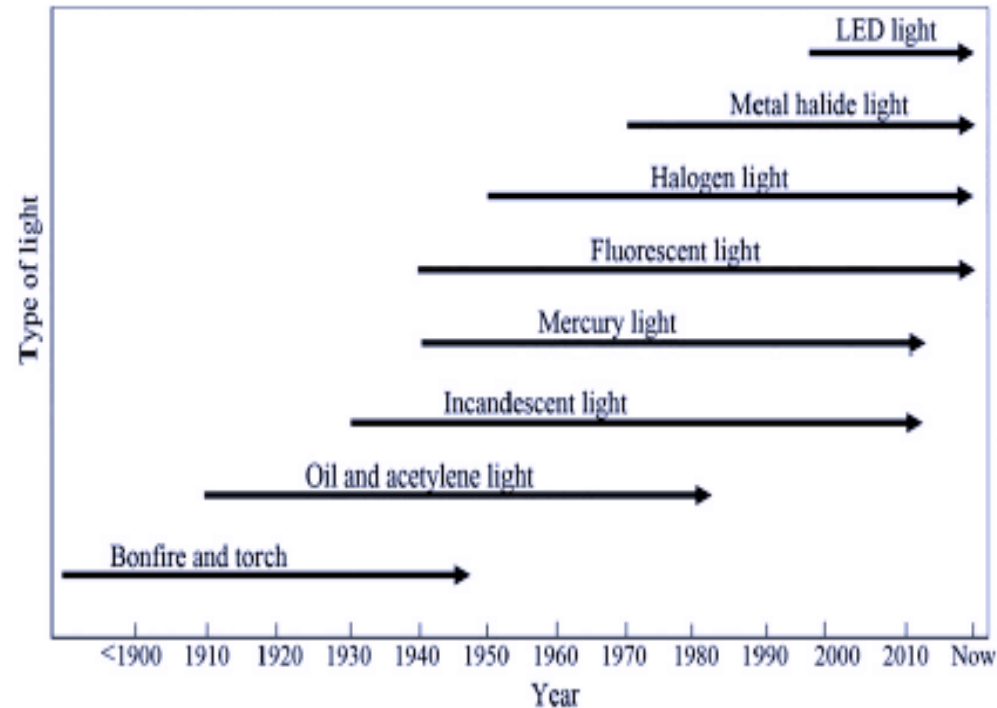
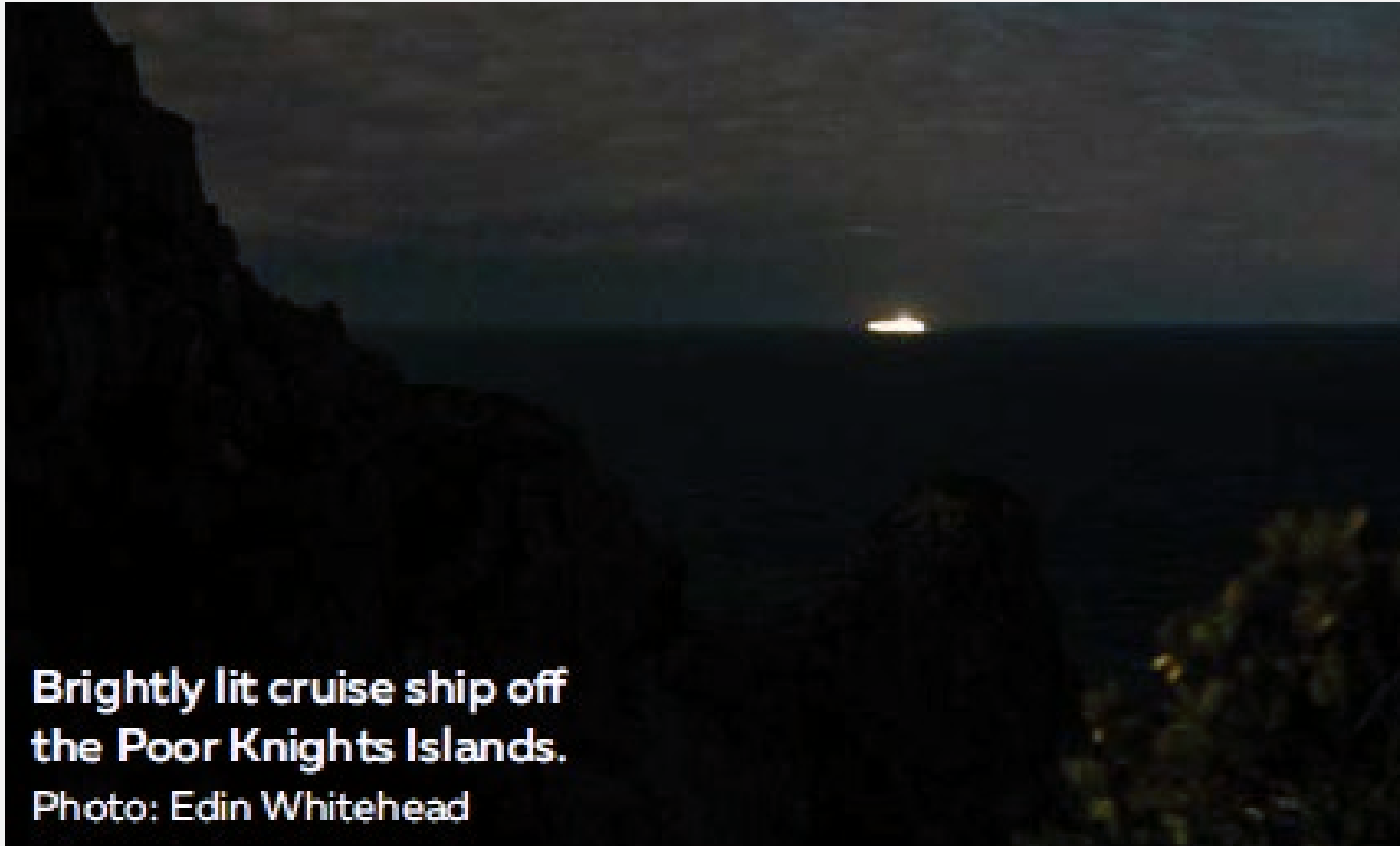


Figure 5. History of technological development of artificial light used in fisheries. Bonfire and torch existed until 1940s. Oil and acetylene light occurred in 1910 and existed until 1980s. Incandescent and mercury light introduced in 1930s and 1940s, respectively, and operated until 2010. Fluorescent, halogen, metal halide and LED light introduced in 1940s, 1950s, 1970s, and 2000s, respectively, and today, only these four types of light are commonly used (modified from An, 2013).





Brightly lit cruise ship off
the Poor Knights Islands.
Photo: Edin Whitehead

STUDIES OF DIFFERENT
LIGHT TYPES AND
SEABIRD ATTRACTION

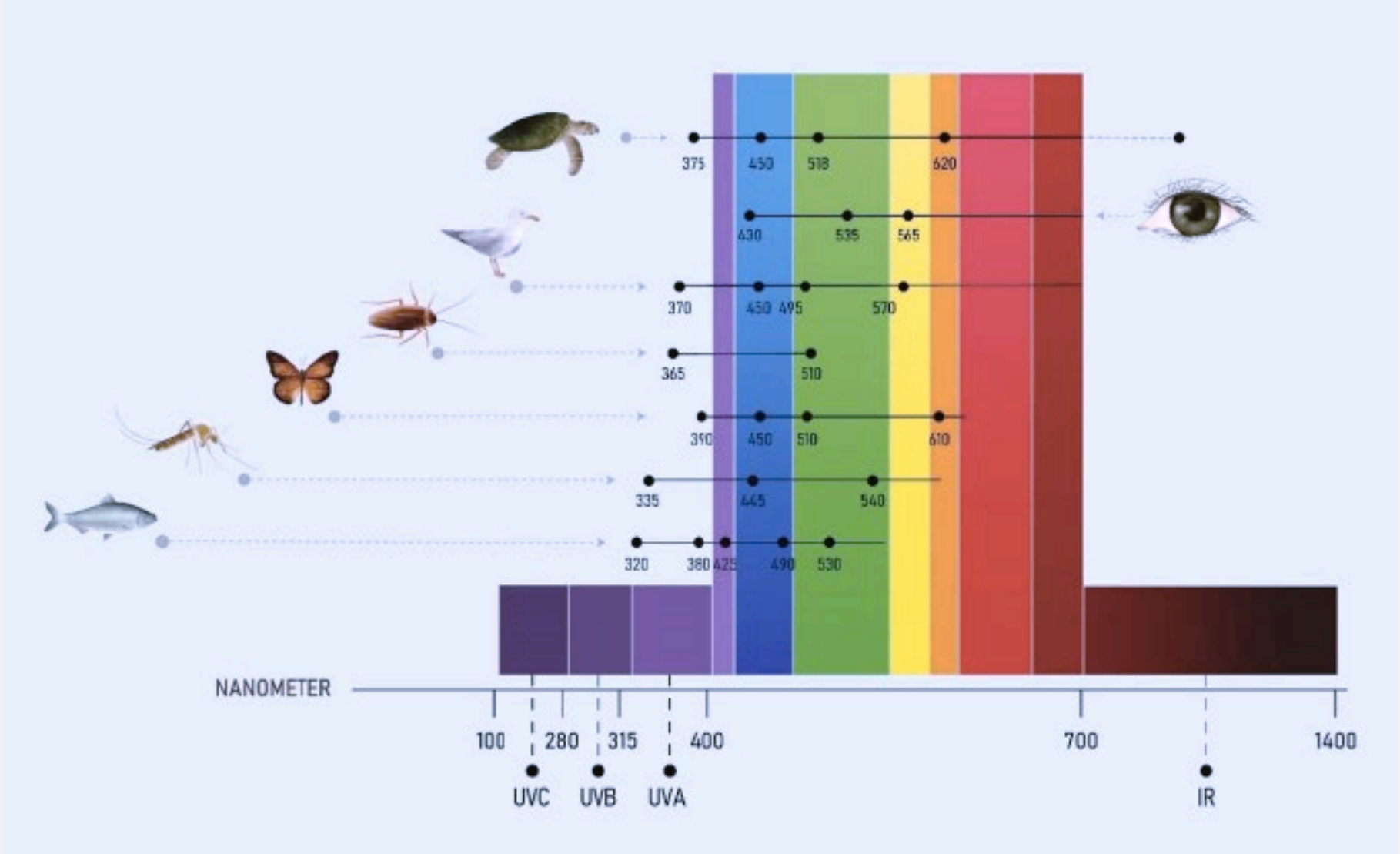
Reed et al. 1985, 1986 & 1987 did field experiments in Hawaii that were inconclusive

Rodríguez et al. (2017) in Phillip Island, Australia tested high pressure sodium, metal halide and LED lights in urban environment near Short-tailed shearwater colony

Metal halide had highest fallout rate at 47%

LED - 29%

High pressure sodium - 24%



ENVIRONMENTAL
INFLUENCES ON
SEABIRD FALLOUT

The moon phase is an important factor

Little fallout during full moon

More ambient light

As is weather

More birds attracted to artificial night on
overcast/foggy nights

Water droplets refract light, increasing lit-
up area

Hides the moon, difficult to navigate

SEABIRD ATTRACTION
TO ARTIFICIAL LIGHT AT
NIGHT – NEW ZEALAND
CONTEXT

New Zealand is a global seabird hotspot with one quarter of the world's species breeding here

Most endemic species

Most threatened species

Examples of seabird attraction to artificial light from Kaikoura, West coast/Punakaiki, Whakatane, Mokohinau Islands, Hauraki Gulf, throughout EEZ

SEABIRD ATTRACTION TO
ARTIFICIAL LIGHT AT
NIGHT – NORTHERN NEW
ZEALAND CONTEXT

27 species of seabird in Hauraki Gulf region

Mainly on offshore islands

Lights on vessels (fishing vessels, cruise ships, cargo ships) near seabird islands pose a threat to the species that breed there

Especially fledglings

Especially those already considered threatened.

Table 1. Fledgling dates for seabird species in northern New Zealand at risk of deck strike. Table adapted from DOC (2019).

Species	Season			
	Spring (Sept – Nov)	Summer (Dec – Feb)	Autumn (March – May)	Winter (June – Aug)
Kuaka/Common diving petrel (<i>Pelecanoides urinatrix</i>)	Nov – Jan	Nov – Jan		
Little shearwater (<i>Puffinus assimilis</i>)	Nov – Jan	Nov – Jan		
Oī/Grey-faced petrel (<i>Pterodroma gouldi</i>)		Dec – Jan		
Tītī wainui/Fairy prion (<i>Pachyptila turtur</i>)		Jan – Feb		
Pakahā/Fluttering shearwater (<i>Puffinus gavia</i>)		Jan/Feb		
Takahikare-moana/White-faced storm petrel (<i>Pelagodroma marina</i>)		Feb – March	Feb – March	
Tītī/Cook’s petrel (<i>Pterodroma cookii</i>)			March – April	
Tītī/Pycroft’s petrel (<i>Pterodroma pycrofti</i>)			March – April	
Tītī/Sooty Shearwater (<i>Pterodroma griseus</i>)			April - May	
Takoketai/Black Petrel (<i>Procellaria parkinsoni</i>)			April – June	April - June
Rako/Buller’s shearwater (<i>Ardenna bulleri</i>)			May	
Toanui/Flesh-footed shearwater (<i>Puffinus carneipes</i>)			May	
Tītī/Black-winged Petrel (<i>Pterodroma nigripennis</i>)			May – June	May – June
New Zealand storm petrel (<i>Fregetta maorianus</i>)			May – June	May - June

Table 2. Conservation status of seabird species in northern New Zealand at risk of deck strike. Threatened status retrieved from the IUCN Red List (2019) and DOC (2019).

Species	Conservation status		Endemism
	IUCN	DOC	
Black-winged Petrel (<i>Pterodroma nigripennis</i>)	Least Concern	Not threatened	Native
Oī/Grey-faced petrel (<i>Pterodroma gouldi</i>)	Least concern	Not threatened	Native
Kuaka/Common diving petrel (<i>Pelecanoides urinatrix</i>)	Least Concern	At risk - relict	Native
Little shearwater (<i>Puffinus assimilis</i>)	Least concern	At risk – recovering	Native
Titī wainui/Fairy prion (<i>Pachyptila turtur</i>)	Least concern	At risk	Native
Pakahā/Fluttering shearwater (<i>Puffinus gavia</i>)	Least concern	At risk - relict	Endemic
Takahikare-moana/White-faced storm petrel (<i>Pelagodroma marina</i>)	Least concern	At risk - relict	Native
Rako/Buller’s shearwater (<i>Ardenna bulleri</i>)	Vulnerable	At risk – naturally uncommon	Endemic
Titī/Cook’s petrel (<i>Pterodroma cookii</i>)	Vulnerable	At risk - relict	Endemic
Titī/Pycroft’s petrel (<i>Pterodroma pycrofti</i>)	Vulnerable	At risk - recovering	Endemic
Titī/Sooty Shearwater (<i>Pterodroma griseus</i>)	Near threatened	At risk - declining	Native
Takoketai/Black Petrel (<i>Procellaria parkinsoni</i>)	Vulnerable	Threatened – nationally vulnerable	Endemic
New Zealand storm petrel (<i>Fregetta maoriana</i>)	Critically endangered	Threatened - nationally vulnerable	Endemic
Toanui/Flesh-footed shearwater (<i>Puffinus carneipes</i>)	Near threatened	Threatened – nationally vulnerable	Native

MITIGATION MEASURES
SUGGESTED IN THE
LITERATURE

Reduce or eliminate lighting especially
during fledgling season

Shield lights

Using filters or different colour/intensity
lights

Using different types of lights

Prohibit the use of lights on
foggy/overcast night