CSP Annual Plan 2023/24

Public submission

Submitted by Chris Gaskin and Edin Whitehead, Northern NZ Seabird Trust

Our submission relates to one project INT2023-10.

General comments

The key question is, will the research approach outlined in the project proposal answer the research questions posed in the project description?

Population sizes won't change over the course of a season barring extreme food deprivation – monitoring breeding success is only one of several metrics that would need to be measured to understand the impact on the populations. Three years is too short a timeframe to gather meaningful trend data from breeding success alone. It is also necessary to look at sub-lethal indicators of stress, as seabird parents are adaptable to variability in available prey resources (behavioural changes in foraging locations, duration, and prey-switching). For a better understanding of impact, monitoring the mass of chicks and adults, and the foraging trip durations of adults would provide a better indication of how changes in available prey are impacting the ability of the populations to breed successfully.

There are several mechanisms by which fisheries could impact on seabirds (i.e., indirect effects)

1. Fish biomass removal – **lowers competition**. In multispecies foraging associations, fish and seabirds are often preying upon the same species. Also, does this release from predation increase zooplankton productivity, and if so, how is that prey source becoming available to seabirds?
2. Facilitation removal – **reduces accessibility** of zooplankton to seabirds through feeding associations with fish school activity, especially surface feeders (<5m diving depth).
3. Does zooplankton remain available but is less concentrated and more difficult to access? Planktivorous diving petrels and storm petrels do not generally feed in association with fish schools, however their populations appear to be thriving in the Hauraki Gulf. Shearwaters can be seen feeding over krill swarms at times, away from fish school activity.

We currently lack a good understanding of how much these species rely on feeding in association with fish schools – what proportion of their time is spent foraging in association vs. independently of fish schools (e.g., along current lines, over krill swarms away from fish schools, around reef systems)

Fairy prions and fluttering shearwaters have been shown to be largely reliant on krill (euphausiids and nauplii) during breeding stages, prey assumed to be captured by their feeding en-masse in associations with fish schools.

White-fronted terns are largely piscivores, largely feeding over kahawai schools, or schools of small fish (e.g., anchovies, piper, sprats). While they may feed on zooplankton this would only be detected through DNA analysis of scat sampling (provided adequate primers are available to detect these species). However, collecting fresh scat from tern colonies can be difficult without causing considerable disruption to nesting birds.

Question: Would fairy prions be a better indicator for this study than white-fronted terns, as they are more of an obligate planktivore?

Here follow suggested edits to the project description:

INT2023-10 Impact of fisheries extractions on pelagic foraging seabird populations in the wider Hauraki Gulf area

Project Code: INT2023-10

Start Date: 1 July 2023 Completion Date: 30 June 2026

Guiding Objectives: CSP Objective D; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objective:

1. Improve understanding of food-web dynamics and the potential impact of fisheries extractions on foraging success through modelling of seabird feeding associations and biomass availability in fish schools.
2. Monitor fluttering shearwaters, fairy prions ~~s~~ and white-fronted terns ~~populations~~ based on these species high-level foraging association and dependence on fish schools ~~and low population sizes within the Hauraki Gulf region~~.
3. Assess changes in food availability in fish schools, including inter-annual variation, through identification of prey in regurgitations (FLSH, FAPR), and DNA analysis of scat samples from all three species ~~fluttering shearwaters and white-fronted terns and~~ to identify changes in plankton productivity.

Rationale

Seabird populations in the Hauraki Gulf (e.g., gulls, terns, gannets, fluttering shearwaters, fairy prions, Buller's shearwaters) are either at risk, or have seen population declines in recent years. Fish schools provide a valuable food source for seabird populations by bigger fish in the school (e.g., kahawai, trevally, , mackerel spp, and skipjack tuna) driving smaller prey species (plankton, krill, small fish) to the surface

Commented [CG1]: Does this require further at sea sampling and observations of fish school activity on a regular basis? It is not possible within the suggested budget.

Also, captures of target species (FLSH and FAPR) at sea while foraging and obtaining regurgitations will provide very accurate data on diet,.

Commented [CG2]: Pinkerton et al note: "For birds, we find that the species likely to be most affected by a change in the biomass of small/medium pelagic fish is the white-fronted tern (amplification factor 2.81). This means that if the biomass of the bird group as a whole is estimated to change by 10% in response to a change in the biomass of small/medium pelagic fish, we may expect the biomass of white-fronted tern to change by 28% because this species eats more fish and has a higher consumption rate than average for species in the bird group. The next 6 bird species in order of decreasing amplification factors were: Buller's shearwater (1.80), fluttering shearwater (1.70), Caspian tern (1.66), fairy prion (1.62), sooty shearwater (1.60), and flesh-footed shearwater (1.42).

WFTE - fish dominate diet
FLSH - mixed krill fish diet
FAPR - krill dominate

Diving petrels and storm petrels - zooplankton dominant, but do not commonly associate with fish schools.

Commented [CG3]: Fairy prions are a species that are mostly closely linked to fish school activity and feeding almost exclusively on zooplankton and larval fish.

However,they are very difficult species to monitor on the Poor Knights Islands (the only site in northern NZ)

Commented [CG4]: The HG is one of the strongholds for fluttering shearwaters with major populations on the Hen and Chickens, Mercury and Aldermen Islands (all within the HG Marine Park). We have established study sites at Burgess Island, Korapuki and Tawharanui. Muriwhenua (NW Chickens) is also another very useful site to study this species.

Commented [CG5]: We ran a photography competition across the 2022-2023 of images of WFTE carrying prey in their bills at different stages of the season. Prey id'd included a range of fish species, squid and some other prey (e.g., a crustacean, beetles), but no zooplankton. DNA would be required to determine the level of zooplankton in their diet.

where they are available to seabirds. These schools of large fish are also targeted by commercial fishers. While fisheries outtake of small pelagic fish species (of the size suitable for seabird prey) is considered minimal in the Hauraki Gulf / Northland / Bay of Plenty region it is the impact on the food web of removing larger fish that is in question. Fisheries extractions of QMS fish species ~~like kahawai and trevally~~ may have an indirect negative impact on seabird feeding if less aggregations of big fish result in less biomass of plankton, krill and smaller fish being driven to the surface for the birds to feed on. It is necessary to better understand this relationship and the impact on the wider food web, and how it may be changing the feeding ecology of seabirds and subsequently impacting seabird populations. In order to achieve this, seabird populations will need to be monitored to look for temporal trends, model the impact of fewer/smaller fish schools on food availability to seabirds, and to look at temporal variation in what species are available to feed on from fish school workups, particularly changes in biomass and availability of energy rich plankton. This work will build on previous CSP research including INT2016-04, POP2017-06, POP2019-02 & BCBC2020-08 and will build on modelling by Pinkerton et al (2023) in their report entitled 'The role of low- and mid-trophic level fish in the Hauraki Gulf ecosystem'~~.~~ (New Zealand Aquatic Environment and Biodiversity Report No. 301).

Research approach

Fluttering shearwaters, fairy prions and white-fronted terns ~~populations~~ will be monitored during breeding season using nest surveys at established study sites and, in the case of surface nesting terns, either boat-based surveys and/or ~~-~~aerial photography (drone). Monitoring should entail gathering breeding success data, morphometric data for chicks and adults to assess body condition between years, and monitoring of the foraging trip duration of adult birds to determine the effort involved in returning sufficient prey to chicks. The results will be considered in the context of fisheries extractions in the region during breeding season. This will also consider findings from DNA analysis of prey species found in regurgitations and scat, also blood samples for stable isotopes. ~~and the modelling of impacts on populations with reduced biomass availability of prey species (plankton, krill etc.) for adults to feed chicks during the breeding season due to fisheries extractions and environmental variables (e.g., sea temperature and primary productivity).~~ Stable isotope analysis of prey samples will assist in ground-truthing data from blood samples, and enable multi-year comparisons of a greater number of individual birds than can be feasibly sampled (regurgitation/faecal) otherwise. These data will contribute towards modelling the impacts of reduced biomass availability of prey species (plankton, krill etc.) due to fisheries extractions on the ability of seabird adults to successfully feed chicks during the breeding season, and also consider pertinent environmental variables (e.g., sea temperature and primary productivity).

Outputs

Commented [CG6]: Making krill less accessible to seabirds. Krill swarms away from fish school activity do exist periodically

Commented [CG7]: Stable isotope analysis will not answer this question, and faecal DNA may lack the resolution to do so in a meaningful way.

Commented [CG8]: Population metrics are subject to lag - behavioural (foraging trip duration) and morphometrics (adult and chick mass, chick growth rates) will be more pertinent at a seasonal scale relevant to this project. Is three years a sufficient time period to get accurate idea of population trends, especially as other forcing factors (marine heatwaves) will similarly impact breeding success.

Commented [CG9]: Where is this data coming from - extent and scale of removal in areas where seabirds forage?

Commented [CG10]: Pinkerton et al note: "**Non-trophic interactions**
Some important non-trophic connections are not explicitly included in the modelling approach used here. In the Hauraki Gulf, seabirds (like fairy prions and Buller's shearwater) and cetaceans have been observed to feed on krill and small/medium pelagic fishes in association with species like kahawai and trevally (Kozmian-Ledward et al. 2020). It is hence possible that changes to the abundances of kahawai and trevally (which are targets of the purse seine fishery) could lead to changes in the availability of small/medium pelagic fishes or other prey (like macrozooplankton) as prey of seabirds. Although these effects are not explicitly included in the modelling, changes to the biomass of small/medium pelagic fishes arising from any means, including due to changes in associated species such as kahawai and trevally, are covered by the perturbation scenarios of the model. This means that even though seabird/kahawai/trevally feeding associations are not included in the modelling, our investigations include the potential consequences of changes to this interaction. Future studies should also include investigations of changes to the abundance or availability of zooplankton (especially krill) in the Hauraki Gulf, and the models developed here could help with this."

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1. A technical report that describes the potential impact of fisheries extractions on seabird populations in the Hauraki Gulf region that will inform fisheries management.

2. All data will be provided to DOC in an electronic format.

Note: A three-year term is proposed

Indicative Research Cost: $30,000

This amount is not sufficient to account for multiple trips to seabird breeding colonies across a three-year period – as trips will be necessary at least twice (to gather egg/fledge data for each season as a breeding success metric). Boat, supplies, and field team costs all need to be considered, in addition to paying for the expertise that the analysis of these data will require.

Cost Recovery: F(CR) Item 4 (100% Industry) Fish stocks: EMA1, GMU1, JMA1, KAH1, PIL1, SNA1, STN1, SWO1, TRE1

Page 3: [1] Commented [CG11] Chris Gaskin 27/04/2023 11:40:00 am

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