

Fisheries and Seabirds – The need for net-free beaches

This FIDO Backgrounder No 69 (2014) is based on the very astute observations of Lindsay Dines of Teewah Beach. Lindsay is an amateur fisher who noted the nexus between fisheries and seabirds in the Great Sandy Region over many years. From his Cooloola Coast home Lindsay has taken an interest in seabird feeding and he concludes that seabirds and fish are as directly affected by inshore commercial netting.

Bait-fish are critical for both larger fish and birds:

Small pelagic fish species are the predominant prey of seabirds. Also some birds become entangled in recreational and commercial fishing gear. That is one reason for studying them. Lindsay feels that there is another vital aspect associated with seabird feeding that has received little attention and that may be causing serious depletions across most seabird populations. Lindsay's observations have mainly focussed on the behavioural dynamics of fish species that are commercially netted. These species appear to be severely depleted by inshore commercial netting.

"Bait-balls" help both fish and fowl: Commercially targeted predatory fish species include the mackerels, tunas, trevallies, tailor, Australian salmon, bonito and queenfish. All are vital to the survival of many of our seabirds. These schooling species herd small baitfish such as sardine and anchovy to the ocean surface as a 'bait ball' where they become easier targets. They then also become more accessible to seabirds. Without predatory fish or dolphins to do this herding, the baitfish would stay deeper in the water column so as to avoid predation by seabirds. This herding is a mutually beneficial arrangement. Seabirds keep the baitfish 'balled' for longer. That enables more efficient feeding by the fish and seabirds for longer periods. Tailor are known to regurgitate their stomach contents to enable further feeding in these situations which prolongs and enhances the feeding opportunities for attendant seabirds. This relationship between predatory fish and seabirds occurs in all aquatic habitats and has done so for perhaps millions of years.

Declining fish stocks: The predominant herders of baitfish in Fraser Island and Cooloola, inshore region are the mackerels, tunas and tailor with several other species such as dart and trevally occasionally performing this role. While declining steadily in number since the 1970s, schools of these species were being sighted from the shore, or located by fishers not far offshore, up until around 2010. Since then, despite conducive rainfall conditions their inshore presence has been conspicuously absent.

Inshore fish stocks depleted: Tailor populations on the Sunshine Coast have recently been identified by Fisheries Queensland as being low with the collapse of commercial yields in 2011, 2012 and 2013 along with diminishing recreational catches since 2000. Tailor are acknowledged to be migrating further offshore and to be smaller than was the case in the 1970s. Concerns for Queensland's inshore fish populations generally are wide spread with a long list of species appearing to be in decline.

Low inshore numbers of the mackerels, tunas and tailor impacts seabirds that are dependent on their herding abilities to feed. The ready availability of feeding schools of predatory fish in the surf zone or near shore region permitted land-based seabirds to easily locate schools within short flight distances from their roosting sites. This has enabled resting periods on nearby beaches between feeding sessions and regular feeding of chicks. But when the schools are further offshore, then seabird population suffer through insufficient, or less nutritious sustenance along with increased energy consumption.

"Spooking": The term '*spooking*' in essence describes a flight reaction by the fish to the net which is perceived by any net harvested species to be a predator. It is common knowledge in commercial and recreational fishing circles that a haul of netted fish will 'spook' the other fish in the region of the netting and further fishing of that region will be unproductive for a period of time. My observations suggest that this is a part of the daily life of fishes, seabirds, dolphins and sharks. Fish have evolved with predators that take relatively few prey at a time. They haven't come to terms with commercial fishers who can take thousands of prey in minutes and are predators to which the fish haven't evolved an effective anti-predator response.

Warning signals: As with terrestrial animals, fish can detect predators and alert each other of the presence of predators by utilising several different finely tuned methods of detection and signalling that have evolved over time. Sound in water travels five times faster than in air and for greater distances which allows fish to listen for predators and communicate audibly when a predator is detected in the region. Similarly, predators can locate prey by listening for their vocalisations or the sound of other predators feeding on prey. Chemical alarm signals by fish that are startled by or are being preyed upon by a predator are released into the water in forms that warn other fish that danger exists in the region. Predators can also locate prey using their olfactory abilities to detect any chemical cues from their prey.

The Sounds of Fish

- Over 700 species of fish around the world have had their vocalisations recorded on hydrophones since 1964 and placed on a database.
- An individual species may have up to nine different vocalisations.
- In Australia, recordings have been made of garfish, black jew and muloway, but many of our species are found elsewhere in the world and have been recorded.
- Static and mobile hydrophones are being used in fisheries management in various locations around the world to assess stock levels and spawning time/location.
- Hydrophones can help fishers to locate individual and aggregated fish.
- Vocalisations are of a lower frequency to those made by dolphins and whales.

Sounding the Alarm and Avoidance: Netted fish release vocal and chemical alarm signals with an intensity and in quantities unequalled in any natural context. When trapped in a net their alarm chorus of vocalisations travel for many kilometres through the water. On hearing these alarm signals, fish that perceive a net to be a predator flee away from the netted region. Flight reactions are instantaneous and can occur more than 10 kilometres from the netted site.

Avoidance of areas thought to be up to 20 – 30kms in all directions from the netted site may last for up to a week. Over time fish develop a general avoidance of dangerous locations where netting regularly occurs. This leads to population declines through overfishing and populations moving offshore to avoid inshore fishing pressures.

Maintaining fish aggregations: Our fisheries are largely based upon the evolved aggregation tendencies of species for spawning or feeding purposes. Such evolved tendencies coincide with environmental factors such as water temperature and flood or with prey species' spawning migrations and dynamics. Fisher knowledge of time of year and locations for such aggregations has provided efficient and consistent harvests, but with obviously high costs in terms of species' recruitment. Long term targeting of aggregations and especially those of inshore species is causing these species to alter their evolved spatial dynamics in order to avoid heavily netted spawning regions or individual nets. Displacement from evolved spawning and feeding grounds and the environmental characteristics and prey availability that has afforded survival of affected species in the past has repercussions for spawning and feeding success. Egg fertilisation and larval survival are compromised, growth rates and fecundity reduced and vulnerability to disease increased. Mortality rates associated with the displacement of fish species due to net avoidance are believed to be potentially as high as the harvest itself.

One targeted species warns others: The use of alarm signals by fishes is a key to understanding the behavioural dynamics of commercially targeted fish species and the dependent seabirds. All species that have a history of being netted will respond to the alarm signals of any species in a net because the net is a common predator to them all. This means, for instance, that tailor recognise the alarm signals of mullet and will always flee a net that contains only mullet because both species are taken by nets and are of the same 'prey guild'. The mackerels and tunas and all other netted species react likewise, even if some of these species are only taken infrequently as bycatch in nets intended for other species. Netting of mullet during their spawning migration that occurs all along the Queensland and New South Wales coastline during autumn and winter, leaves little option for these species other than to move offshore to find safer habitats. The implication of heterospecific anti-predator responses such as that of tailor to mullet alarm signals is that there is little value in fishery managers banning just the netting of tailor, for instance, should the protection of tailor be desired.

Response: Science established that there is an anti-predatory response to alarm signals in fishes. Observations of flight reactions by tailor, mackerel and tuna to mullet nets confirms that the science is applicable to these species in South East Queensland's inshore waters. The science applies to every net deployed irrespective of locality and inshore species are most affected. It does not matter which species are in the net, as they all vocalise and each species can recognise alarm signals being emitted by all other species.

Altered tern behaviour: Recently Cooloola has seen changes in the feeding behaviour of each of the tern species that inhabit this region at various times of the year. Once the terns would leave their roosts early in the morning and search for schools of feeding predatory fish, now they rarely look at the water for prey. They forage for insects along the beaches and above the dunes as well as scavenging for scraps left by tourists and fishers on the beach. This naturally exposes the terns to potential entanglement in fishing lines and the swallowing of fish hooks, but such a dietary change has further implications to energy levels, growth rates and fecundity as well as egg strength and will clearly result in increased mortality rates.

Without action: The causes for the reduction in number of populations of migratory and sedentary seabirds are likely to be numerous. Survival of seabirds into the future in a changing climate will require all of these potential causes to be addressed in one manner or another. It is quite apparent however that our seabird populations are inextricably linked to that of predatory fish populations and that by maintaining healthy predatory fish and baitfish populations, seabirds are afforded greater opportunities for survival.

Nets are the problem: Healthy inshore fisheries, or the recovery of overfished species and regions, have been demonstrated to be attained by closing regions to commercial netting and particularly those of significant spawning or feeding importance. We now know why this is the case as the fish are seeking safe refuges from nets. But even without this awareness of why, net free regions must now be a major ambition of marine and seabird conservationists alike because we know they work. Although this may be perceived as being at the expense of the commercial fishery and the supply of fish to the general public, this hasn't proven to be the case as commercial yields outside of net free regions are documented to increase. Viability for individual fishers improves rather than decreases.

Licence buy-back needed: To create net free regions, it is a costly exercise for Governments to buy out commercial licence holders that harvest regions of high ecological value. In Queensland funds for the buy out of commercial licence holders for the creation of net free regions are not being made available despite increasing demands by the concerned recreational fishing public. Selling fishing permits to recreational fishers in Queensland on the basis that the new fees would contribute to the establishment of net free regions could help fund the buy-back of commercial licences.

We certainly can't allow the continued depletion of inshore fish stocks. The situation has now become urgent. Now is the time for implementation of a recreational fishing permit system and for strategic net free regions to be created. Our fisheries, seabirds, sharks and dolphins are absolutely dependent on it.



Lindsay photographed this school of permit (*Trachinotus blochii* sometimes referred to as "oyster crackers" or "snub nosed dart") on Teewah Beach in 2010. The netted fish most likely emitted sounds of distress which spooked other fish in the area. Every single mullet that is trapped in a net emits what is known as a "startle and escape vocalization" or "alarm signal" by drumming muscles against their swim bladder which amplifies the sound, to warn other mullet of the slaughter.