

## SHAGS AND THE TAUPO FISHERY

Shags are commonplace around Lake Taupo and as known fish predators their impact on the trout fishery is often questioned by anglers. In this article we review what is known about shags in this area and their interaction with the trout fishery.

Four species are native to Lake Taupo - the Black Shag (*Phalacrocorax carbo*), Little Black Shag (*P. sulcirostris*), Little Shag (*P. melanoleucos*) and less common Pied Shag (*P. varius*). These range in size from the Little Shag which is 55-65 cm in length and 0.4 to 0.8 kg in weight, to the Black Shag of 80 to 85 cm in length and 2 to 2.5 kg.

Shags roost in communal groups. Most evident on Lake Taupo are the colonies on Motutaiko Island and scattered through the Western Bays. Nests are built either in large trees such as the pohutukawa trees on Motutaiko Island or amongst cliff-face crevices and ledges. Several breeding colonies have also been located in the upper parts of the Tauranga-Taupo, Waiotaka and Tongariro rivers. The pair bond is monogamous and maintained mostly or entirely at the nest site. The male selects the site and advertises for a mate. Once accepted the female builds the nest using twigs and other material brought by the male. The same nest may be used year after year.

Usually a single brood of 2 to 4 eggs is laid, hatching approximately one month later. Young are fed by incomplete regurgitation and are fed and attended by both parents for two to three months after fledging. After breeding most river shaggeries are abandoned in favour of lakeside roosts.

During the day birds may fly several kilometres to the feeding grounds, returning to the communal roost at night. When not feeding individuals rest for up to one-and-a-half hours allowing the food to digest and may use several resting sites during the course of a day's feeding. Such sites may be the same ones used for night roosting but also partly submerged branches, boat jetties or the harbourmaster's beacon on Horomatangi Reef.

Shags feed mostly on fish, usually close to the surface. Fish are caught by surface diving or underwater pursuit swimming. In water the shag plumage is permeable and sheds air so that buoyancy is reduced. Out of water, though, the plumage repels water, trapping air and increasing insulation. This reduction in buoyancy aids swimming but limits the time which can be spent in cold

water to less than 30 minutes. Small prey are swallowed underwater but large fish are grasped from above, just behind the gills, and brought to the surface. Such a grasp often causes the hooked top bill to puncture the side of the fish, not unlike a spear wound. The Black Shag swallows large fish headfirst by tossing them into the air but in other species they may be carried to the shore to be eaten. Koura (freshwater crayfish) are shaken on the surface to snap off the claws before being swallowed. Little Black Shags will sometimes feed in dense flocks of up to 50 or more birds, working together to herd small fish.

From limited dietary studies bullies and koura are the most important prey in Lake Taupo but smelt, goldfish and trout are all taken occasionally. Smelt were found to be a significant prey item amongst Rotorua shags and anecdotal evidence suggests that, at least seasonally, smelt are taken in large numbers at Taupo also. Bull (1983) suggests only the Black Shag regularly takes trout from Lake Taupo. This is supported by Potts' 1972 study on the neighbouring Rotorua lakes in which he found no trout amongst 169 Little Shag and 79 Little Black Shag stomachs sampled throughout 1971. However one Black Shag out of seven examined contained one 1 kg rainbow trout. Prior to the introduction of trout and smelt it is also likely that the then extensive koaro (*Galaxias brevipinnis*) populations were an important food source. Dietary studies elsewhere suggest they will take a wide variety of freshwater prey including eels, various whitebait species, trout, perch, carp, crustacea (crabs) and invertebrates. Despite such a diverse diet studies indicate that when a number of fish species are available shags often adopt preferential feeding, selecting only one or two species. Which species are chosen seems to vary from locality to locality.

It is difficult to estimate just how many shags occur in the Taupo basin as a complete census has never been undertaken, but it is likely to be in the order of several thousand. Casual observation suggests that numbers are probably similar to those in the past. For example W C Buller in 1888 comments that Captain Mair, who accompanied a hunting party to the "Tauranga River at Lake Taupo" (= Tauranga-Taupo River?), saw 400 Little Shags collected in a single day. P J Burstall recalls that in the 1950s the Tauranga-Taupo shaggeries used to contain from 750 to 1000 birds.

The impact of this number of birds on the trout population is unlikely to be significant. There is no evidence that either the Little Shag or Little Black Shag, which comprise the bulk of the population, take trout regularly from Lake Taupo. These birds are not very large and most trout in the lake are at least 150 mm long. It is probably easier to feed on the more abundant smaller fish such as bullies. However, shoals of much smaller trout do occasionally occur around the lake margin and these are likely to be more susceptible to shag predation. The Large Black Shag does take trout occasionally though

there are probably only three or four hundred birds in the whole fishery (Cam Speedy personal comment).

The greatest impact may occur in the streams rather than the lake. From a cliff top, the author has witnessed a Large Black Shag swim 100 metres underwater downstream in the Waimarino River. As it encountered each group of spawning fish they flared apart and moved slightly upstream while the shag passed on downstream. Unsuccessful, the shag surfaced and flew back up to the start of the beat to repeat it. No doubt shags aren't always so unsuccessful. Usually, along the spawning tributaries early in the winter while the rivers are still very low, a handful of dead fish bearing scars of shag damage will be found. Later in winter under high flows very few shag kills are found, suggesting the adult trout are perhaps better able to avoid the shags under these conditions. There are resident shags on many stretches of all the Taupo tributaries and these, at least in part, are likely to feed on juvenile trout present over the summer. It is just another gauntlet juvenile trout must run, as they have had to since their introduction into the fishery 100 years ago.

Shags (cormorants) are found worldwide and are significant predators on trout in their native waters. The trout life history of producing thousands of eggs per adult female has evolved, in part to counter the impacts of such predation. It's all part of the bigger picture and calls to control what is a native species solely to minimise this impact could not be justified.

There is an overlap between the diet of shags and trout and potentially the opportunity for competition. Shags, however, are shallow water feeders whereas the bulk of trout feeding occurs at much greater depth. Smelt are the predominant prey of trout and evidence indicates that the huge smelt populations are limited in size by the availability of food rather than any effects of predation.

From 1915 to 1959 shag destruction programmes were undertaken in the Rotorua/Taupo region largely to try and reduce the incidence of shagworm. This is a nematode (*Eustrongylides sp.*) which develops within the stomach of the shag, releasing fertile ova which are passed out in the shag's excreta. If dropped into the water the ova develop into larvae which are eaten by small fish such as bullies. These in turn are eaten by shags and the cycle starts again. Occasionally, however, the bullies are eaten instead by trout, which in turn become infected. The worm causes a large watery filled cyst to develop within the body wall of the trout which, when approximately the size of a golf ball, ruptures through the skin ultimately causing the death of the trout. Such infected fish are reported on average to us about every two months, but in other areas such as the Waikato River and in Lake Taupo in the past the incidence is or was much higher.

In 1910-11, Internal Affairs records show, the average weight of rainbow trout caught by anglers was 8.75 lb. However, in 1913 the quality of the fishery began to deteriorate until in 1917-18 the average weight was only 3.25 lb. According to reports, increasing infestations of "shagworm" accompanied this decline. It was assumed that "shagworm" was the cause of this decline in the quality of the trout and that if the incidence of shagworm were reduced the fishery would return to its original state. To that end it was thought the destruction of shags would break the 'shagworm' cycle.

It is now known that the deterioration of the fishery was caused by an inadequate food supply. High shagworm infestations were a symptom, rather than the cause, of the deterioration.

The decline in the fishery was finally halted with the introduction of smelt in the 1930s which formed huge populations and now form the dominant component of the trout diet. Smelt appear a lot less susceptible to shagworm, perhaps because they spend so much of their life in deep water away from the shallows most frequented by the shags. Whatever the reason, because trout feed so heavily on smelt (up to 90% of the diet of immature trout) the incidence of infection by shagworm is now relatively low and certainly does not justify any control of the shag populations.

In summary, shags are a native species to Lake Taupo. They have a similar role in the dynamics of the Taupo fishery to that of related cormorant species in the fisheries, from which Taupo stocks are derived. Their predominant prey are small fish and koura, not trout, which they share with the trout population. These prey species exist in huge numbers and are food limited so that competition between trout and shags is unlikely to be significant. The diet of shags varies between localities and while trout may be a much more important part of the diet elsewhere, that is not the case in Taupo. Anglers need not fear the impact of shags on the Taupo fishery.

#### References:

- Bull, P C (1983) - Aquatic Birds of the Lake and Its Surroundings in *Lake Taupo, Ecology of a New Zealand Lake*, DSIR Wellington, pp 133-150.
- Dickinson, P (1951) - Stomach Contents of New Zealand Inland Shags, *Australian Journal of Marine and Freshwater Research* 2(2) 1951, pp 245-253.
- Falla, R A & Stockell, G (1945) - Investigation of the Stomach Contents of New Zealand Freshwater Shags, *Transactions of the Royal Society of New Zealand, Volume 74, Part IV*, pp 320-331.
- Falla, R A., Sibson, R B., Turbott, E C (1978) - *The New Guide to the Birds of New Zealand* - Collins, Auckland.
- Marchant, S & Higgins, P - *Handbook of Australian, New Zealand and Antarctic Birds, Volume 1* - Oxford University Press
- Potts, K J (1972) - *Aspects of the Ecology of Shags in the Rotorua District* - Ph.D. thesis, University of Waikato.
- Readers Digest, Sydney
- Robertson, C.J.R (1985) - *Complete Book of New Zealand Birds*.
- Stonehouse, B (1967) - Feeding Behaviour and Diving Rhythms of some New Zealand Shags, *Phalacrocoracidae, Ibis* 109, pp 600-605.