USE OF PUKEPUKE LAGOON BY WATERFOWL

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SUMMARY: This is a preliminary account of some basic waterfowl population studies being undertaken at Pukepuke Lagoon, the first such studies so far attempted in New Zealand. Attention has been focussed on the popular game species of duck; the introduced mallard (*Anas platyrhynchos platyrhynchos*), the native grey duck (*Anas superciliosa superciliosa*) and New Zealand shoveler (*Anas rhynchotis variegata*). Seasonal fluctuations in population density, sex-ratios, nesting season chronolgy and the influence of water levels on hatching success are discussed.

Introduction

Pukepuke Lagoon (40° 20'S, 175° 16'E) and its associated swampland, because of its limited public access proximity to two universities and crown title, lends itself to pressing researches on wetlands.

Since 1968, when the Wildlife Service of the Department of Internal Affairs began data collection on waterfowl utilisation of the area, the project has grown in scope and impetus. Other researches in the project include:

(1) Growth rates, energy exchange and development of raupo (*Typha muelleri*).
(2) Representative basin status for the catchment — the behaviour of water in a sandy environment.
(3) Limnology, seasonal variations in plankton and chlorophyll levels.
(4) Ecology and population studies of mustelids.
(5) Habitat utilisation by small rails—marsh crake (*Porzana pusilla affinis*) and spotless crake (*Porzana tabuensis plumbea*).
(6) The influence of birds grazing on adjacent pastures.
(7) Breeding biology and ecology of pukeko (*Porphyrio porphyrio melanotus*).
(8) Population dynamics and growth rates of eels (*Anguilla spp.*).

The studies involve the Wildlife Service, Victoria and Massey Universities and the Hydrology Division of the Ministry of Works.

Three species of dabbling duck — mallard (*Anas p. platyrynchos*), grey (*Anas s. superciliosa*) and New Zealand shoveler (*Anas rhynchotis variegata*) — use Pukepuke Lagoon regularly. Grey teal (*Anas gibberifrons gracilis*) are common visitors and a single brown duck (*Anas aucklandica chlorotis*) was recorded in 1969.

Of the game species (mallard, grey and shoveler) only mallard and grey have been studied in detail (Balham 1952, Balham and Miers 1959, Reid 1966 and Williams 1969). While grey and shoveler have figured prominently in the works of Buller (ed Turbott) 1967, Guthrie-Smith (1927), Oliver (1955), Soper (1972) and others, their accounts, apart from plumage notes, have largely been anecdotal.

This is the first attempt in New Zealand to quantify observations of numbers, sex-ratios and breeding success of the game ducks, and it will be expanded as our studies continue.

Methods

Pukepuke Lagoon consists of a main water area of about 15 ha and three smaller areas of about 1.5, 0.4 and 0.4 ha respectively. Daily observations, usually totalling four hours, are made from two tower hides and a tree platform.

Counts of numbers of individuals, sex-ratios and broods, when present, usually begin in June and cease in February. Pre-game season preparations by hunters in March and the game season itself, which extends through six weekends from the first Saturday in May, greatly affect the numbers of ducks to be seen. Counts are not attempted during this period.

The frequency of daily counts have not been constant from year to year. In the 1968-69 breeding season, counts were made twice weekly; only brood count data from that season have been used here.

In 1969-70 and 1970-71, from June through February, about 20 counts were made each month. For 1971-72 however, and henceforth, the total monthly counts have been reduced to a block of seven successive days, but here brood counts are made for a further 13 days each month.

Data presented on nesting chronology are based on broods observed several times. The age of the broods at first sighting were each back-dated to determine an approximate hatching date. The average incubation period and clutch size for each species are — mallard 27 days, 13 eggs; grey 27, 10; shoveler 25, 11. Eggs are normally laid daily. These two figures added together and to the estimated age of the brood at first sighting give, by subtraction, the approximate date on which laying began.

RESULTS AND DISCUSSION

1. *Seasonal Fluctuations in Duck Numbers*

Data in Figure 1 show the influence of the breeding season on the numbers of ducks present through each counting period. The lowest number recorded was 67 in October 1970 and the highest was 1,565 in February 1972.

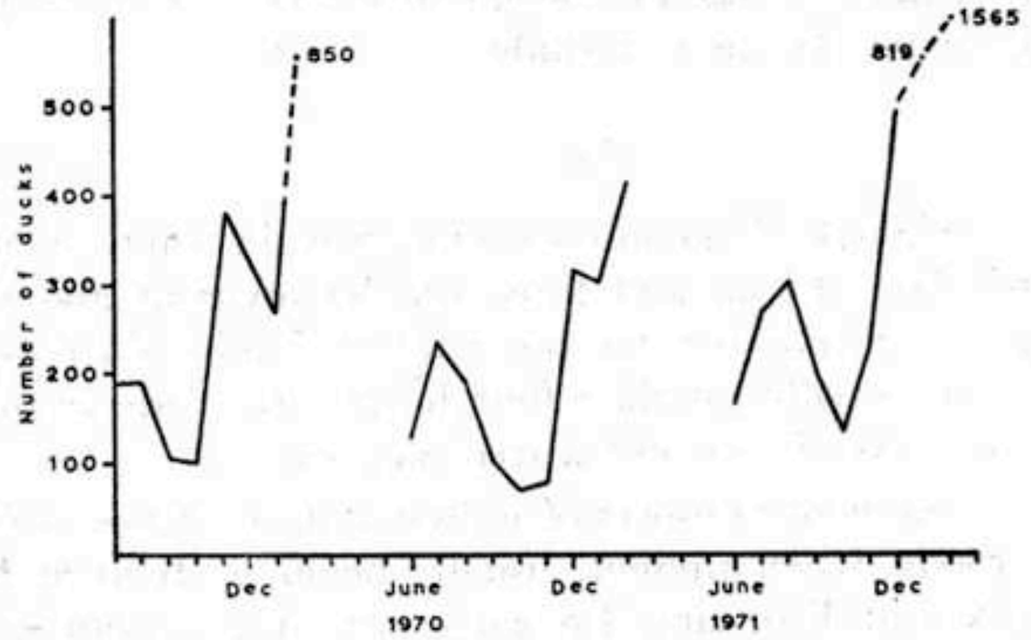

FIGURE 1. *Number of ducks (mallard, grey and shoveler) (monthly mean).*

The pre-breeding population of pairing birds reaches its maximum in either July or August. The peak of incubation when the majority of females are not on the lagoon and, therefore, are not counted, occurs in October. The rapid rise in numbers from then on is caused by an influx of unemployed drakes of all species and the flying young of the year from other breeding grounds.

During the game season mallards dominate the local population. They have ranged from 62 percent to 72 percent of the ducks shot over the five game seasons since 1968 (Caithness 1968, 1969, 1970, 1971, 1972). Greys fluctuated from 19 percent to 30 percent while shoveler were relatively unimportant, ranging from seven to nine percent of the ducks shot.

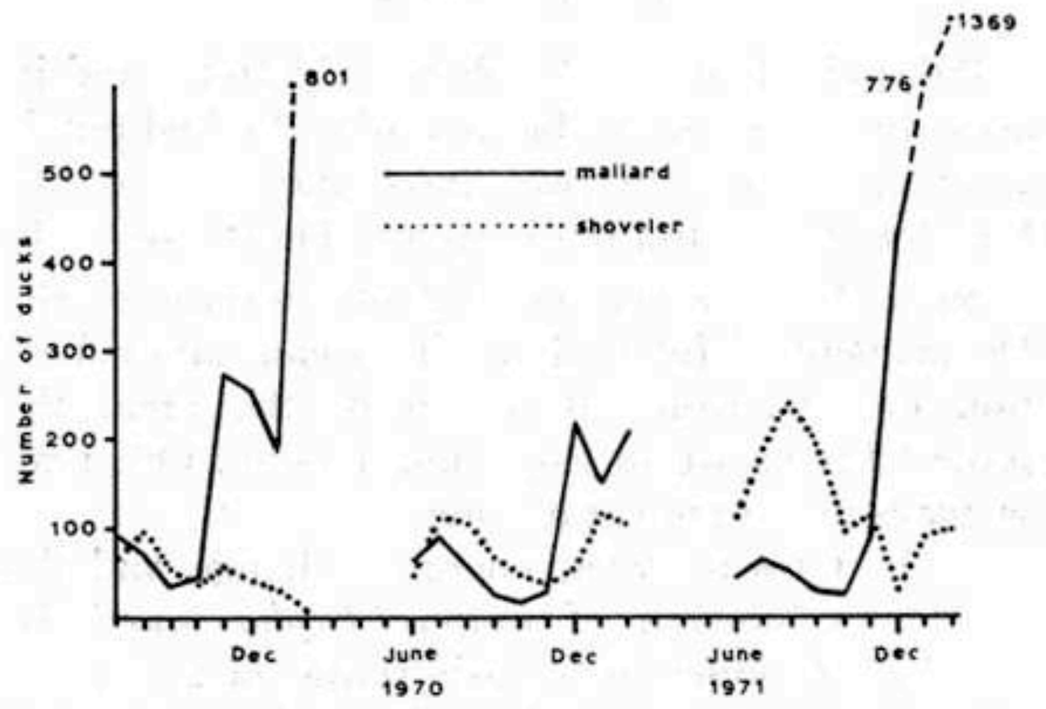

FIGURE 2. *Number of mallard and shoveler (monthly mean).*

Despite the low numbers of shoveler harvested by hunters, they were dominant in the pre-breeding population. This was especially so in 1971 (Fig. 2). Shoveler broods seen later, however (in each year 1969-70 12 broods, 1970-71 13 broods and 1971-72 28 broods), only account for 27 percent of the previously counted pairs. Two factors, singly or in combination could cause this discrepancy: The lagoon may be used extensively for pairing, but nesting and rearing of young largely occur elsewhere; alternatively 73 percent of the population either fail to breed or are non-breeders.

2. *Sex-Ratios*

Sex-ratios may be inferred from separate counts of males and females of dimorphic species such

as mallard. Following mild winters some mallard females begin incubating eggs in mid-August and are not seen on the lagoon, and male ducks from late (February) broods do not fully adopt their nuptial plumage until late May. Thus, for mallard, only counts made in June and July normally give acceptable results. Hard winters, such as that of 1969, occasionally delay the onset of breeding and extend this period by about one month.

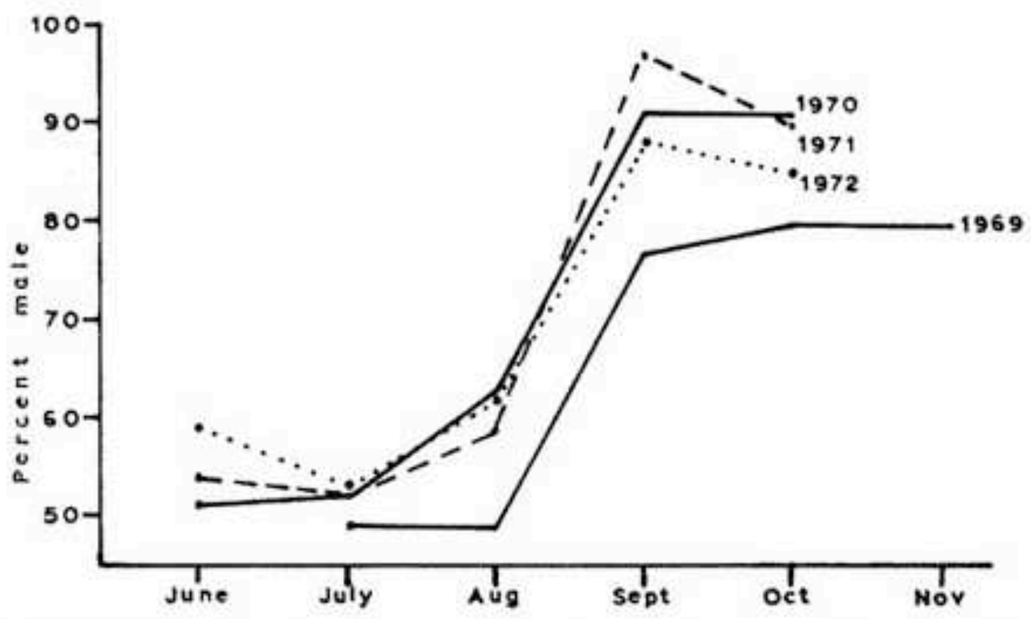

FIGURE 3. *Proportion of males in the mallard population (Monthly mean percent) (1969 July - August 1711 ducks, 1970 June - July 1756, 1971 June - July 626, 1972 June - July 680).*

Figure 3 shows that the mean pre-breeding (June-July) and (August (1969)) sex-ratio for 4,773 mallards from 1969 to 1972 was 51.2 male: 48.8 female; the proportion of males ranged from 48.9 to 54.4, and of females from 51.1 to 45.6.

The only other published sex-ratio data for wild mallards in New Zealand are those of Balham and Miers (1959). They found for a trapped sample of 4,683 a sex-ratio of 55.7: 44.3 in favour of males, and concluded there was no *a priori* reason to assume trap bias was responsible for the difference. These data differ from our observations ($\chi^2_1 = 18.4$ $P<0.001$). Since 1957, the Wildlife Service have trapped and banded a further 28,002 wild mallards, for which the sex-ratio is 53.9 male: 46.1 female. Again, very different from our data ($\chi^2_1 = 41.4$ $P<0.001$). The two trap sample sex-ratios are not significantly different from each other.

The difference in sex-ratio between the trapped and counted samples of mallards is too great to be dismissed as sampling error. Both sets of data are reliable as far as operator determination of sex is concerned.

Bellrose *et al.* (1961), in their comprehensive paper on sex and age ratios of North American ducks, acknowledge trapping bias favouring males. In the same paper the authors quote Lebret (1950), working in the Netherlands, as saying: "Sex-ratio field counts of migratory duck do not reveal the sex-ratio in the species as a whole, but only differences in the migration of the sexes."

Differential migratory habits are obviously a complicating factor in establishing the true population sex-ratio in the northern hemisphere. In New Zealand, only dispersals are known to occur. However, once incubation begins, drakes of most species congregate in large flocks in favoured areas for their post-nuptial moult. By February, the common time of the year to trap ducks in New Zealand, most drakes have completed their moult. If, however, the trapping station is established close to a moulting ground, and the drakes have not yet entirely redispersed through the population, there is every probability they will appear in the traps in exaggerated numbers. Furthermore many females are themselves moulting in February, they are not then available to be trapped. We consider, therefore, that samples of ducks from trapping stations are unlikely to reveal the true population sex-ratio, whereas field counts such as we present here are more reliable.

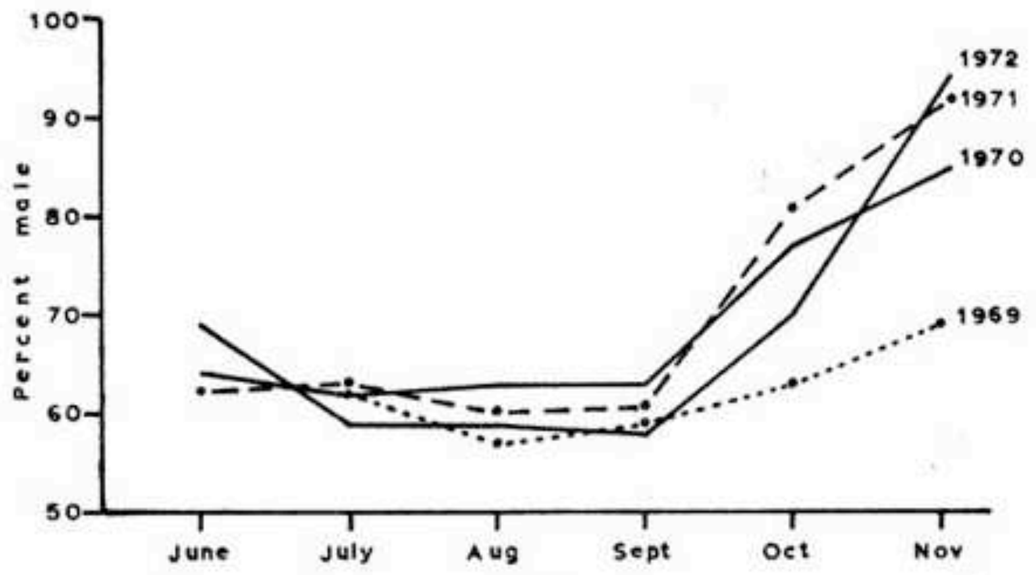

FIGURE 4. *Proportion of males in the shoveler population (Monthly mean percent) (1969 July - September 2771 ducks, 1970 June - September 4249, 1971 June - September 4524, 1972 June - September 1025).*

The seasonal sex-ratio of shoveler follows a similar trend to that of mallards (Fig. 4). Their shorter breeding season, however, permits reliable counts to be made for a further two months, June to September inclusive. The mean pre-breeding sex-ratio for 12,569 shoveler from 1969 to 1972 was 60.5 male : 39.5 female, range 61.6 - 57.7 male : 42.3 - 38.4 female.

3. *Nesting Season Chronology*

Nesting (laying and incubation) of mallards has been remarkably synchronous (Fig. 5) regardless of water levels or other environmental factors. Only an 11 day variation in the onset of laying has been observed between years and, similarly, laying has ceased with only a ten day variation between years. It follows then that the duration of egg laying for each year should be similar. From the 1968-69 to the 1971-72 breeding season, the egg laying periods of mallards were 130, 124, 134 and 130 days respectively.

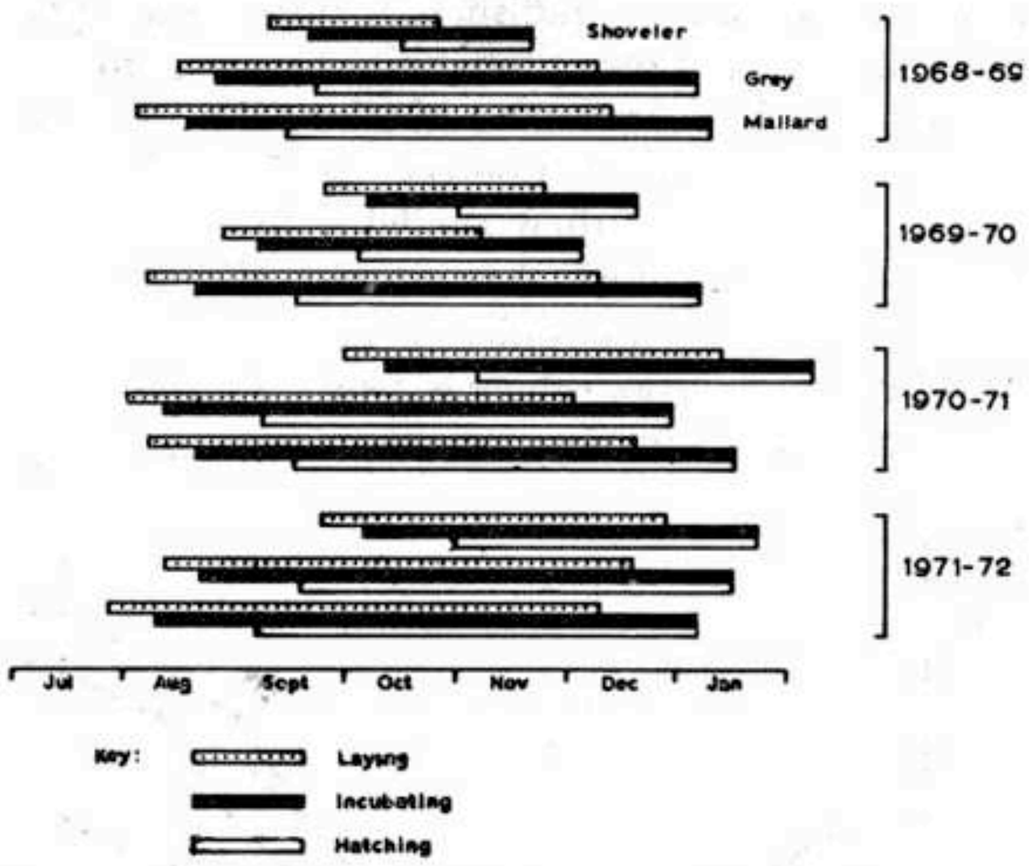

FIGURE 5. *Nesting performance of shoveler, grey and mallard over four breeding seasons 1968-1969 to 1971-1972.*

Mallards, except in 1970, were the first to begin laying, they were followed about two weeks later by greys and a further three to six weeks later by shoveler. Balham (1952) found a similar sequence of weeks in the first laying dates of mallards and shoveler. No apparent synchrony was observed in the date when the three species ceased laying. Repeat nesting or renesting probably masked any specific differences.

Figure 5 sets out the nesting duration for shoveler, grey and mallard ducks over four nesting seasons.

4. *Influence of Water Levels on Hatching Success*

Data in figure 6 show the water levels recorded at Pukepuke Lagoon during the 1969-70, 1970-71 and 1971-72 breeding season. (Water levels were not recorded in 1968-69. Field observations however, did not reveal any marked rise above normal and seemed comparable with the levels of 1969-70).

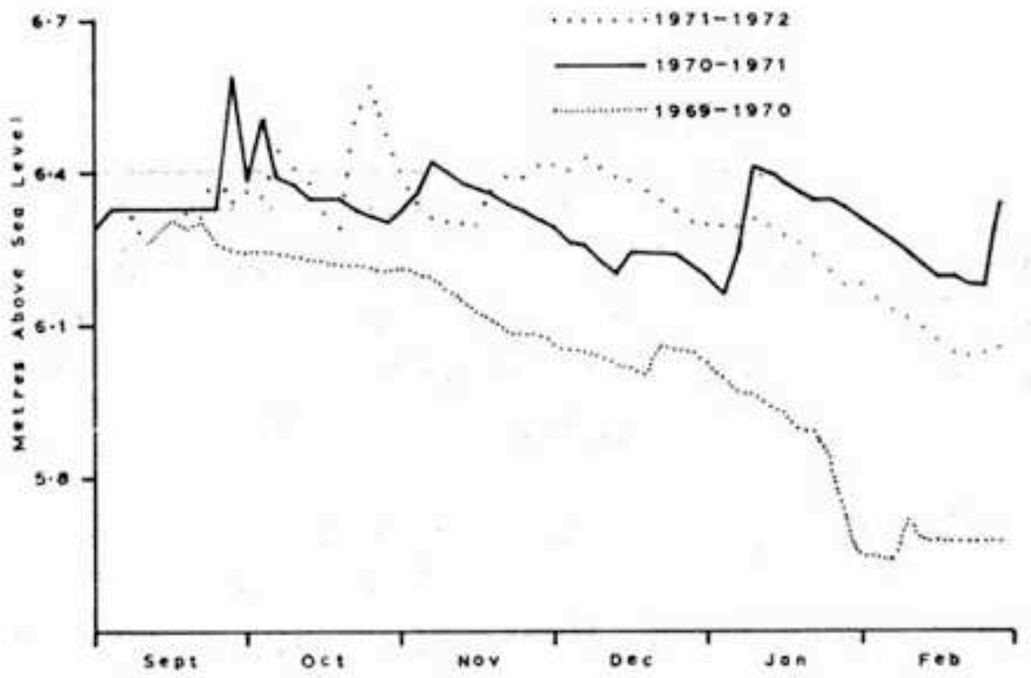

FIGURE 6. *Water levels (m above mean sea level) during three breeding seasons, 1969-1970 to 1971-1972.*

When these data are compared with those in Figure 7, they show that water levels and mallard hatchings in 1969-70 were compatible. In 1970-71 however, a rise of 230 mm in water level in late September, when egg laying and incubation are near their peak, had an adverse effect on hatching. Only three broods appeared in October compared to 30 the previous year. Renesting apparently occurred, with these broods appearing in November, but despite renesting only 30 broods were produced for the whole season compared to 53 the previous year, a drop of 43 percent.

Again, when water levels recorded in 1971-72 are compared with the mallard hatching success

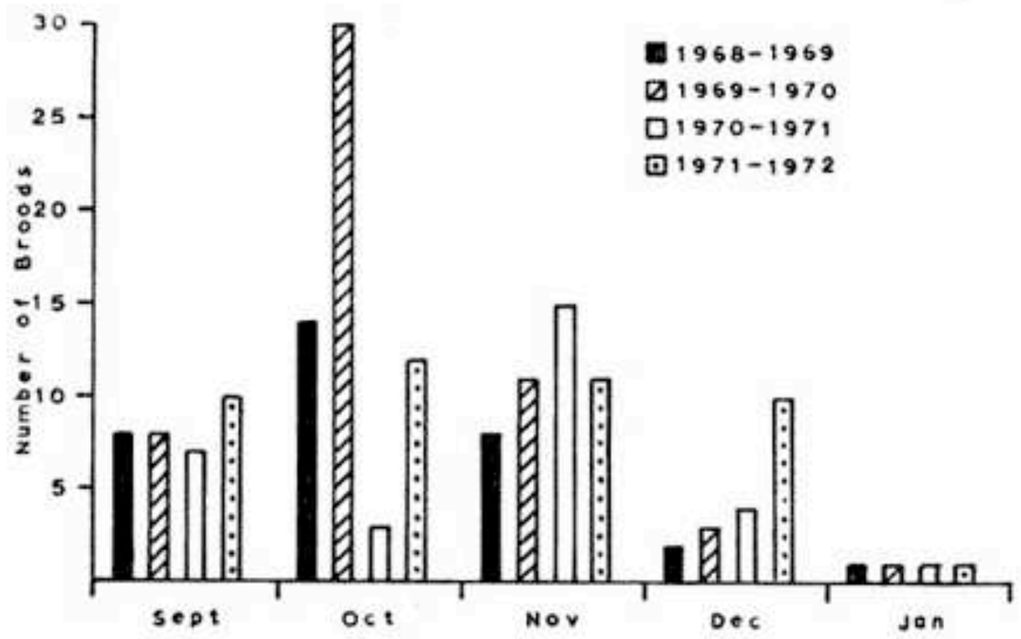

FIGURE 7. *Numbers of mallard broods hatching per month of the four breeding seasons 1968-1969 to 1971-1972.*

in that year, a similar sequence of events was recorded. A sudden increase in water level occurred in the third week of October, this rise reduced the number of late October broods markedly. As a consequence, December broods, because of renesting, were greater than normal. Despite renesting, the brood hatching success was 17 percent overall lower than that of the stable water level year 1969-70 but was 32 percent better than in 1970-71. Data for grey duck (Fig. 8) are probably too few to be completely reliable. Nevertheless, the high water levels of October 1971 appear to have resulted in substantial renesting with many more broods appearing in December than expected.

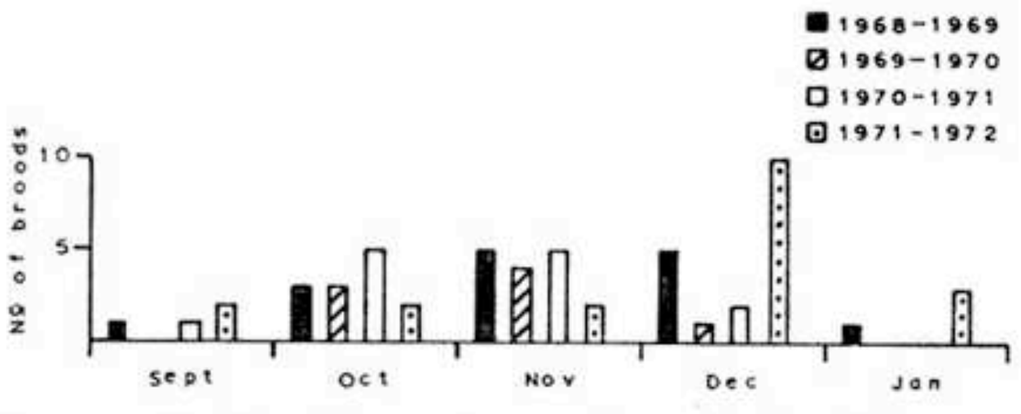

FIGURE 8. *Numbers of grey broods hatching per month of the four breeding seasons 1968-1969 to 1971-1972.*

Shoveler (Fig. 9), because they nest later than either mallard or grey and usually select "safe" nest sites on higher ground, have not noticeably been affected by any of the water level fluctuations.

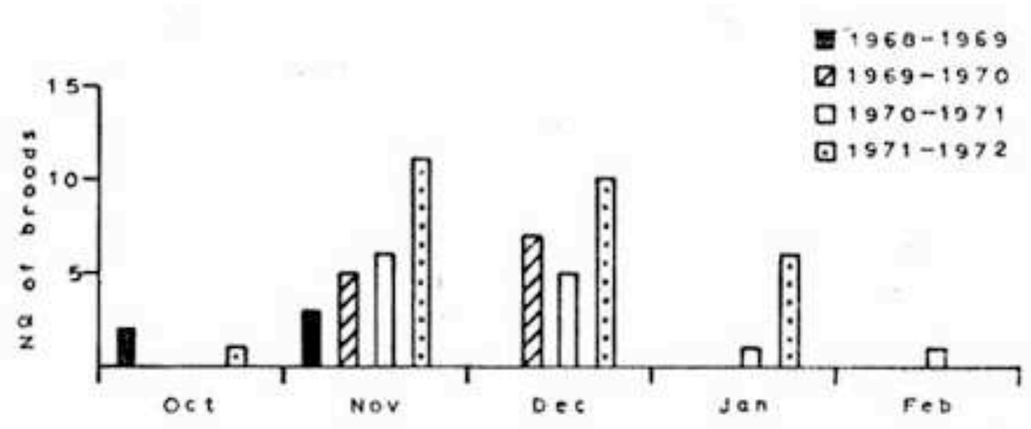

FIGURE 9. *Numbers of shoveler broods hatching per month of the four breeding seasons 1968-1969 to 1971-1972.*

Stable water levels, therefore, are fundamental to a successful waterfowl breeding season. This especially applies to mallards and greys which nest close to or over water.

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