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PARENT–YOUNG VOCAL COMMUNICATION IN WESTERN GREBES[1]

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Abstract. Field observations indicate that Western Grebe (*Aechmophorus occidentalis*) parents use two vocalizations, *Ticking* and *Clucking,* to affect head movements of newly hatched chicks being carried on their back. Playbacks of *Ticking* calls result in chicks hiding their heads beneath the back feathers and being silent, while *Clucking* calls result in chicks poking their heads out and begging loudly for food. *Ticking* calls heard within a colony are given primarily by parents with chicks, not by individuals without offspring. Observations outside of the colony suggest that it functions as an alarm signal to chicks, and not as a generalized alarm signal to mates or other members of the colony.

Key words: *Western Grebes;* Aechmophorus occidentalis; *communication; alarm calls; vocalizations.*

INTRODUCTION

Within 1 to 5 hr of hatching the last egg, Western Grebes (*Aechmophorus occidentalis*) abandon their nest and head for open water, carrying their newly hatched semialtricial young on their backs. This early "back-brooding" period may last for several weeks, with one parent serving as a mobile brooding platform while the other parent forages for the young. Either parent may carry the young, and male and female exchange roles at intervals of 0.5 to 2 hr. With each trip to the brood, the foraging parent brings a single food item. Meanwhile, the back-brooding parent follows closely, thereby keeping to a minimum the distance travelled by the foraging parent per food trip.

Frequently in their first 2 weeks, Western Grebe chicks are completely hidden by their parents' back feathers; thereafter chicks gradually become more and more visible and independent. Parents with chicks on their backs can be detected from a distance by their slightly fluffed, "hunch-backed" posture and by their reluctance to dive. When a pair is approached by potential predators (e.g., humans), chicks already on the back of a parent hide beneath the parent's feathers while those in the water rapidly scramble onto either parent's back. On the other hand, when approached by the foraging parent, even chicks completely hidden beneath the back feathers immediately poke their heads out and beg vigorously.

Parents appear to initiate these actions by the chicks primarily by using two vocal signals: *Ticking* and *Clucking* (Fig. 1A, B). In this paper I examine the contexts of these two vocalizations and present field observations and experimental evidence as to their probable functions.

METHODS

This work was part of long-term studies on the breeding biology and behavior of Western and Clark's grebes (*Aechmophorus clarkii*) conducted from 1973 to 1979 and resumed again in 1984 to 1987. Studies were conducted at the Delta Marsh and Marshy Point on Lake Manitoba, Manitoba, Canada, at Upper Klamath Lake, Oregon, and at West Toqua Lake, Big Stone County, Minnesota. The field data, sound spectrograms, and playbacks reported in this paper pertain strictly to Western Grebes, although general field observations on Clark's Grebes suggest that they have similar or identical parent-young vocalization signals.

Field observations on parent-young interactions were made from a mobile floating blind disguised as a muskrat house, which allowed me to enter a colony and make close observations, often within several meters of the nest or parents with young (Nuechterlein 1982). Members of a pair were sexed visually by bill size, which is larger in males (Palmer 1962, Storer and Nuechterlein 1985), or vocally by using the *Advert sing* call, which is lower pitched and longer in males (Nuechterlein 1981b). I obtained field recordings of *Ticking* and *Clucking* calls at close range by using a Uher directional microphone and Uher

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Report-L tape recorder carried inside the blind. A Uniscan II real-time analyzer was used for sound spectrograms.

At Marshy Point, nesting birds passed daily through channels that led to their fishing grounds on Lake Manitoba. From a small cattail island (*Typha latifola*) in the center of one of these 10-m-wide channels, I performed a field experiment to determine the contexts of *Ticking* as an alarm signal. As birds passed within 10 m of the island, they were classified as lone adults, pairs without young, or pairs carrying young. Each bird was subjected to one of two randomly selected, predetermined treatments: (1) a crouched, hidden position (Observer Hidden-control) or (2) an upright position with head and shoulders clearly visible (Observer Visible). As birds passed by, the observer recorded whether or not they gave *Ticking* calls in response to the observer's presence.

I also performed follow-up playback experiments on the contexts of *Ticking* and *Clucking* using a brood of three newly hatched chicks. These were live-captured along with their back-brooding parents using a funnel trap set in a channel leading from the nesting colony at Marshy Point to Lake Manitoba. After capture, both parents calmed down and immediately became silent when placed side by side in the vegetation, each with a dark, heavy sock over its head and one or two chicks on its back. Using this technique, I was able to examine the reactions of their calm, unalarmed, back-brooded chicks to playbacks of *Ticking* and *Clucking* calls without any interference from the parents (see also Nuechterlein 1981a, Nuechterlein 1982).

Playbacks of each call were played in random order at intervals of not less than 2 min. Prior to each playback, the heads of the chicks were either (1) all hidden beneath the feathers or (2) all clearly visible. If need be, I would tuck heads under the feathers or expose them at least 1 min prior to playing the call.

Each time a parental call was played, I recorded the reactions of the chicks (a) during a 1-min period preceding the playback (control) and (b) during the 10-sec playback period. Head movements were recorded as (1) head under (bill and majority of head become hidden under back feathers of adult), (2) head out (bill and majority of head become visible), or (3) no reaction (no change in head visibility). I also recorded whether or not begging calls were given by the chicks.

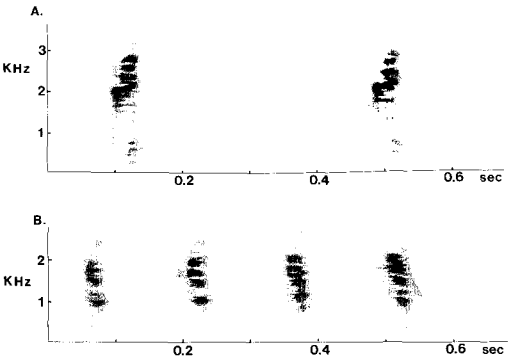

FIGURE 1. Sound spectrograms of (A) *Ticking* and (B) *Clucking* vocalizations by Western Grebes. Amplitude is encoded by dot densities. *Ticking* calls are irregularly spaced, while *Clucking* occurs in bouts of two to six calls.

RESULTS

BEHAVIORAL CONTEXTS OF *TICKING*

When nests of a Western Grebe colony were checked in early to midincubation, most birds left their nests, but remained nearby in the open water until the disturbance to the colony ceased. Except for occasional *Advertising* calls (Nuechterlein 1981b, Nuechterlein and Storer 1982), most birds were silent. During colony checks later in the season, however, I frequently would hear sharp, irregularly-spaced *Ticks* from birds of the colony (Fig. 1A). Individuals giving the call did not open their bills, and the caller was very difficult to identify except at very close quarters. Follow-up observations with the floating blind during disturbances showed, however, that the call was given by males or females with chicks already hatched.

These observations suggested that *Ticking* might be an alarm call given by parents to their chicks, and not a more generalized colony alarm reaction. Rather than diving away from the source of alarm as is typical of Western Grebes, parents having young chicks in the water usually hesitated on the surface and gave *Ticking* calls. Chicks that were in the water then rapidly climbed aboard and ducked beneath the feathers, while the parents departed by surface swimming. Parents carrying chicks on their backs dived only in extreme emergency situations, such as when being closely pursued by a motor boat. Such dives were shorter and less abrupt than normal alarm dives, yet chicks frequently fell off, particularly if more than one chick was on a given parent's back or if

TABLE 1. Diving by Western Grebe (A) parents and (B) nonparents as they passed within 10 m of an observer at an inlet.

	Males		Females	
	Dive	Stay on surface	Dive	Stay on surface
A. Parents				
Carrying chicks	0	46	0	38
Not carrying chicks	14	13	14	15
B. Nonparents	167	7	92	2

several rapid dives occurred. Chicks greater than about 4 weeks of age often responded to *Ticking* by swimming or diving away on their own.

Field observations on parents passing by the channel entrance to Lake Manitoba indicate that males and females were equally likely to be carrying the brood as they left the marsh. Of 86 pairs with broods that passed through the channel, males carried the brood in 32 cases, females in 33 cases, and both parents in 21 cases ($P > 0.05$, sign test). Males and females were equally likely to *Tick*, but a parent carrying chicks was more likely to call than one whose mate was carrying all the chicks (13 out of 22 cases vs. two out of 12 cases, $\chi^2 = 5.7$, df = 1, $P < 0.05$). Parents of both sexes were significantly less likely to dive when carrying young than when not carrying young (Table 1A, $\chi^2 = 29.5$, df = 1, $P < 0.001$ for males, $\chi^2 = 23.2$, df = 1, $P < 0.001$ for females). Even parents not carrying young, however, were significantly less likely to dive than were nonparents (Table 1B, $\chi^2 = 50.8$, df = 1, $P < 0.001$ for males, $\chi^2 = 120.0$, df = 1, $P < 0.001$ for females).

TABLE 2. Contexts of *Ticking* by adult Western Grebes passing through an inlet in relation to (A) the presence or absence of chicks and (B) the visibility of the alarm stimulus (the observer).

	Response to observer	
	Ticking	No *ticking*
A. Observer visible		
Lone birds	0	256
Pairs without chicks	0	44
Pairs carrying chicks	52	4
$\chi^2 = 326.2$, df = 1, $P < 0.001$		
B. Observer hidden		
Lone birds	0	204
Pairs without chicks	0	29
Pairs carrying chicks	17	36
$\chi^2 = 79.5$, df = 1, $P < 0.001$		

TABLE 3. Responses of a brood of three Western Grebe chicks to playbacks of parental calls. Since chicks were tested as a group, the experimental unit was the brood, and partial responses were noted accordingly.

	Stimulus call		
Chick responses	Control period (1 min)	*Ticking* (10 sec)	*Clucking* (10 sec)
A. Heads of all chicks initially hidden beneath the parent's back feathers			
1. Head movements			
No reaction	18	19	3
One head out	2	1	7
Two or more heads out	0	0	10
Significance tests:			
Ticking vs. control: $\chi^2 = 0.36$, df = 2, ns			
Clucking vs. control: $\chi^2 = 23.5$, df = 2, $P < 0.01$			
2. Begging calls			
No reaction	20	19	4
One begs	0	1	5
Two or more beg	0	0	11
Significance tests:			
Ticking vs. control: $\chi^2 = 1.2$, df = 1, ns			
Clucking vs. control: $\chi^2 = 26.7$, df = 2, $P < 0.01$			
B. Heads of all chicks initially exposed			
No reaction	20	7	20
One or more hide head	0	13	0
Significance tests:			
Ticking vs. control: $\chi^2 = 19.3$, df = 1, $P < 0.01$			

The field experiments on alarm reactions of birds at the channel provided strong evidence that *Ticking* is an alarm reaction given primarily by parents with young. Whether the observer was visible or not visible, none of the 460 lone birds or 73 pairs without young that passed by the channel observation point gave *Ticks*. In contrast, nearly all pairs carrying chicks on their backs gave *Ticks* when the observer was visible (Table 2A). The probability of this *Ticking* response diminished significantly when the observer was mostly hidden in the vegetation (Table 2, Chi-square test comparing observer visible vs. hidden treatments for parents with chicks: $\chi^2 = 43.3$, df = 1, $P < 0.001$).

BEHAVIORAL CONTEXTS OF *CLUCKING*

Clucking is a soft vocalization given in bouts of two to six calls spaced 0.1 to 0.3 sec apart (Fig. 1B). *Clucking* can be heard only at close quarters and is given by parents in two related contexts.

The most common of these almost always occurs as a parent returns with food for chicks that are hidden beneath the back feathers of its mate. Chicks usually respond by immediately poking out their heads and begging for food. Parents also usually give *Clucks* when offering feathers to hidden chicks for consumption. This feather-feeding habit occurs in most grebe species, and presumably is related to the formation of pyloric plugs (strainer) and a mass in the stomach that will retain fish bones until they are digested or regurgitated (Storer 1961).

PLAYBACK EXPERIMENTS ON *TICKING* AND *CLUCKING*

Back-brooded chicks reacted in opposite ways to playbacks of parental *Ticking* and *Clucking* calls. Chicks that were initially hidden beneath the back feathers poked out their heads and begged loudly when *Clucking* calls were played, but mostly remained silent and hidden when played *Ticking* calls (Table 3A). Chicks whose heads were initially visible usually begged and remained visible when played *Clucking* calls, but most chicks became quiet and hid their heads from sight when played *Ticking* calls (Table 3B). During control periods few changes in head visibility occurred.

DISCUSSION

All members of the grebe family (Podicipedidae) have the unusual habit of carrying young on their backs. Foraging grebe parents returning with food to a brood that is hidden beneath the back feathers of its mate thus face an interesting communications problem. In Western Grebes this problem is solved by the foraging bird giving a soft *Clucking* call that induces the chicks to poke their heads out to take the morsel. On the other hand, if danger threatens, parents give sharp *Ticks,* which result in chicks scrambling onto their backs and hiding beneath the back feathers. Analogous vocal signals are given also by other grebe species in similar contexts (Cramp and Simmons 1977, unpubl. data), and these may be nearly universal among the grebes.

Observations at the nest during the period of asynchronous hatching suggest that the response to *Clucking* may be learned. One-day-old chicks initially show little response to parental *Clucking,* yet parents returning with food cluck persistently, and this association appears to be quickly learned by the chicks through positive reinforcement. More extensive playback experiments using chicks of various ages are needed to confirm or reject this hypothesis.

None of the colonial grebe species show cooperative defense of nests when approached by humans or other large predators. Instead, most species silently slip off the nest often covering the eggs with sodden nesting material before leaving the colony. Chicks of a brood hatch asynchronously, and parents with some hatched chicks typically carry them away on their backs from the vulnerable nest. Since they can only dive for short distances without the chicks falling off, back-brooding parents are more vulnerable to predators than nonparents, and it is important that the chicks remain hidden. In Western Grebes, *Ticking* appears to be an alarm signal used in this context.

Field experiments on *Ticking* in Western Grebes indicate that it is primarily an alarm signal to a parent's offspring, not a signal to its mate or to other adults of a colony. This supports work on alarm calling in other nonmobbing colonial species such as black-tailed prairie dogs (*Cynomys ludovicianus*) (Hoogland 1983) and Belding's ground squirrels (*Spermophilus beldingi*) (Sherman 1977), which indicates that alarm calling is nonaltruistic behavior directed primarily at close relatives or offspring (Shields 1980), not the entire colonial group.

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