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Some factors determining success of duck hunters in southern British Columbia

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Abstract

A model is proposed to relate duck hunter success to the availability of birds, based on analysis of the time that hunters spend in different activities. Parameters of the model were estimated by test hunters for a series of sites in the Lower Mainland of British Columbia. The field observations suggest that bird density is of little importance in determining success; the important factors appear to be weather and avoidance learning by the birds.

Résumé

Un modèle proposé, destiné à rattacher le succès de la chasse au canard à la disponibilité des oiseaux et basé sur l'analyse du temps que les chasseurs consacrent à différentes activités, fait ici l'objet d'une présentation. Des chasseurs sélectionnés ont évalué les paramètres du modèle dans le cas d'un certain nombre d'emplacements situés dans les basses terres de la Colombie-Britannique. Les observations faites sur place permettent de supposer que la densité de la population de canards n'a que peu d'importance dans la détermination du succès de la chasse; les principaux facteurs semblent être les conditions météorologiques et l'habileté des oiseaux à échapper aux chasseurs.

Introduction

To evaluate the effects of bird availability and restrictive regulation on hunter success is a major problem in waterfowl management. Several strictly empirical approaches have been taken, most notably through multiple regression analyses, but results have not been encouraging. A little-used approach is to treat hunters as animal predators, in order to make use of the powerful conceptual models that have been developed to deal with the predation process. A hunter-success model based on the predation models of Holling (1966) was used in the development of a continental mallard-management simulator (Walters *et al.*, In press). This report describes that success model and the results of a preliminary field study aimed at estimating some of its parameters and evaluating its validity as a management tool.

Our hunter-success model was developed by considering any hunter day as a series of encounters with birds, where the average time between encounters and encounter success determine total bag:

$$\text{Kill per hunter day} = \frac{\text{Total time hunting}}{\text{Av. time to kill each bird}}$$

where

$$\text{Av. time per bird} = \left(\frac{\text{Mean time betw. encounters}}{\text{Prop. successful encounters}} + \text{Handling time per successful encounter} \right) \Big/ \text{No. birds killed per successful encounter}$$

Here an encounter is defined as any occasion birds come within range of a hunter and are shot at; handling time is the average time lost from hunting each time the hunter must leave cover to retrieve birds; and mean time between encounters is the average time from the end of one retrieval period to the next encounter. The key factors considered in the model are thus: (1) total time spent hunting per hunter day, (2) mean time between encounters with birds, (3) proportion of encounters that are successful, (4) handling time per successful encounter, and (5) number of birds per successful encounter. It was expected that total hunting time, birds per encounter, handling time, and proportion of encounters successful would be related to the type of hunting (decoy, pass, jump) and would be relatively constant over time. Thus the primary variable in the model was expected to be mean time between encounters; this factor should be related to bird density, distribution patterns of birds relative to hunters, and overall hunting pressure. It was expected that increased overall hunting pressure would have both positive and negative effects on success per hunter, the positive effects through increased bird movement and the negative effects through avoidance learning. We postulated a minimum time between encounters, which should be a function of flight speed and the distance at which birds will react to shots fired by a hunter (flare radius); we expected that flare radius would increase during any hunting season as birds become more wary.

The model has intuitive appeal in that it distinguishes the factors contributing to success so that they may be studied individually. The most difficult component to study is time between encounters as related to bird density and hunter interaction, since observations are required for a wide range of bird densities during several hunting seasons. In this study (which lasted only one season), we attempted to estimate with some precision those model components that are likely to be constant over time. We also hoped to observe enough variability in time between encounters to permit some statement about the feasibility of more comprehensive studies.

Methods

Most duck hunting in the Lower Mainland of British Columbia is centred around ocean foreshores and along the Fraser River. CWS studies (Taylor, 1970) indicate that duck populations start to increase in early September, and build up to a peak in mid November near the middle of the season. On the other hand, hunting effort is highest early in the season; Brian Gates (pers. comm.) estimated that half of the total

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season bag is taken on the opening weekend. By observing hunter behaviour throughout a season, we hoped to sort out the effects of changing bird density from the effects of avoidance learning.

Three fixed sampling areas were chosen for the study: Mud Bay, Westham Island, and the Pitt Lake – Fraser River junction. Mud Bay is a shallow ocean inlet with extensive tidal flats; ducks of all types use it as a resting area and are hunted mostly by pass shooters. The Westham Island foreshore is an estuarine marsh area inhabited primarily by puddle ducks; hunting is mostly with punts and decoys. The Fraser – Pitt area is a mixed habitat with marshes and open rivers; it is inhabited by all types of ducks, and is hunted mostly by pass shooters. In addition, we were lucky to obtain a block of data from several coastal locations in Oregon, collected during the first 2 weeks of the 1971 hunting season. The Oregon areas are quite similar in general ecology and waterfowl.

In each of these areas, all waterfowl species spend most of their time in large flocks on wide areas of open water, where they are virtually untouched by hunters. Marshes and fields are frequented primarily at night and during severe wind storms. Bay and river shorelines are used extensively as resting areas before the hunting season, but are virtually abandoned after opening day. The species composition of birds moving into huntable areas changes during each day: Mallards and Pintails are encountered primarily in the early morning, while widgeon and teal become relatively more abundant in the late morning and afternoon.

Originally, we planned to station observers in each area on a predetermined series of sampling dates. The observers were to act as test hunters and to record the five time factors listed above for their own plus at least one other hunting party. However, it proved impossible to observe accurately the behaviour of other hunters, especially on foggy or windy days. Most of the data presented below represent measurements by test hunters of only their own behaviour, and may thus not be completely representative. The test hunters were all students and faculty at the University of British Columbia, representing a broad spectrum of experience and skill. Also, it proved impossible to preset the sampling dates, since we wanted samples under a variety of weather conditions. Sampling effort was concentrated on the opening weekend, and in addition test hunters visited each sampling area at least four times later in the season.

Test hunters were asked to behave in ways typical of other hunters in each sampling location when setting up blinds, placing decoys, and deciding how long to stay out. Using standard recording forms, the hunter recorded when each encounter occurred, number and species of birds coming within range, number of shots fired, number of birds killed, and handling time. Each hunter was also asked to note general weather conditions, total number of birds seen in the air, and flare radius (in 100's of yards) of incoming birds still out of range during any encounter.

Results

Overall results from the sampling program are presented in Table 1. We were not able to sample all possible combinations of area, weather, and type of hunting; the observations represent 36 test-hunting trips and 395 encounters. The most striking variation shown by the data was between opening weekend and all other dates (Fig. 1). Success was zero in both of the pass shooting areas after opening day; birds in these areas learned very rapidly to avoid shorelines. We had expected a gradual increase in wariness over the first few weeks of the season, but no trend was apparent. Flare radius appeared to be 0 on opening day (few birds showed any reaction at all to nearby shots), and about 500 – 1000 yards (depending on weather and time of day) afterward. No clear trends in success were observed in decoy areas after the opening day, though the density of birds probably increased until December. The dominant factor affecting success after opening day appeared to be weather; only windy days were at all productive.

The species composition of birds encountered was relatively stable over the season in Lower Mainland areas, but the Oregon hunters encountered relatively few Mallards (Table 2). Our results confirm the findings of Boyd (1971) that smaller species are relatively more vulnerable (kills/shots higher) than large species ($\chi^2 = 11.52$, $P < 0.01$). Most test hunters reported that they did not pass up chances to shoot at small or low quality species, except on a few occasions when birds were very abundant. Relative encounter rates of the major species differed considerably from the relative abundances of these species reported by Taylor (1970) for the Delta region; Mallards were overrepresented in the kill (47 per cent of encounters versus 17 per cent of dabblers present) while widgeons and Pintails were underrepresented (29 per cent and 1 per cent of encounters, respectively, versus 37 per cent and 23 per cent of dabblers present).

The results presented in Table 1 and Figure 1 represent observations on test hunting parties, which usually consisted of two hunters. Thus success per hunter would be about half of the total success per party. We were not able to detect any significant difference in other parameters (i.e., handling time) for those test hunters who went out alone.

Duration of the hunting trip appeared to depend mostly on success. Few hunters stayed out more than 2 hours when the hunting was poor, or more than 6 hours under good conditions. The test hunters averaged about 5 hours per trip, of which typically 10 – 20 per cent was spent in non-hunting activities (moving decoys, travel, etc.), so the overall average hunting time per trip was about 4 hours. It was expected that effective hunting time would be much less than this, as normal bird movement is greatest at dawn and dusk; however, we observed no correlation between time of day and frequency of encounters.

Remarkably little variation was found in proportion of encounters that were successful. Decoy shooters did almost twice as well as pass shooters, and inexperienced hunters had an average success proportion about 0.4 compared to the overall average of 0.55. Likewise, the average number of birds per successful encounter showed little variation; decoy hunters tended to have a slightly higher frequency of two- and three-bird kills. Proportion of successful encounters and birds per encounter did not vary over the

Table 1
Statistics of test hunters from the British Columbia Lower Mainland area, averaged over the 1971 hunting season. Dashes indicate factor combinations that were not sampled

Hunt type	Weather	Location	No. of trips	No. of encounters	No. of successful encounters	Time between encounters	Birds per flock	Shots per encounter	Proportion of encounters successful	Birds per successful encounter	Handling time per encounter
Decoy	Clear	Westham Is	1	11	8	53.3	1.6	2.6	0.73	1.25	4.3
		Boundary Bay	—	—	—	—	—	—	—	—	—
		Frazer–Pitt	1	14	5	26.5	2.6	1.9	0.36	1.20	6.4
		Oregon	1	25	13	14.3	4.9	2.9	0.52	1.38	5.2
	Cloudy-calm	Westham Is	1	15	9	12.0	3.5	2.7	0.60	1.22	4.0
		Boundary Bay	1	9	7	34.8	3.2	3.3	0.78	2.00	1.9
		Frazer–Pitt	1	2	0	95.0	2.0	1.0	0.00	0.00	—
		Oregon	6	41	33	49.2	1.7	2.8	0.81	1.18	3.9
	Windy	Westham Is	5	70	36	18.4	3.6	2.3	0.51	1.19	5.7
		Boundary Bay	0	—	—	—	—	—	—	—	—
		Frazer–Pitt	0	—	—	—	—	—	—	—	—
		Oregon	4	44	31	24.7	6.7	3.8	0.71	1.35	4.1
	Foggy	Westham Is	1	29	14	10.4	3.1	1.5	0.48	1.21	5.3
		Boundary Bay	0	—	—	—	—	—	—	—	—
		Frazer–Pitt	0	—	—	—	—	—	—	—	—
		Oregon	0	—	—	—	—	—	—	—	—
Pass	Clear	Westham Is	0	—	—	—	—	—	—	—	—
		Boundary Bay	3	3	1	68.3	1.7	2.0	0.3	1.00	9.00
		Frazer–Pitt	0	—	—	—	—	—	—	—	—
		Oregon	0	—	—	—	—	—	—	—	—
	Cloudy-calm	Westham Is	0	—	—	—	—	—	—	—	—
		Boundary Bay	0	—	—	—	—	—	—	—	—
		Frazer–Pitt	0	—	—	—	—	—	—	—	—
		Oregon	0	—	—	—	—	—	—	—	—
	Windy	Westham Is	0	—	—	—	—	—	—	—	—
		Boundary Bay	1	5	2	25.3	2.0	2.0	0.40	1.00	1.82
		Frazer–Pitt	0	—	—	—	—	—	—	—	—
		Oregon	0	—	—	—	—	—	—	—	—
	Foggy	Westham Is	1	8	7	11.3	1.9	2.2	0.87	1.00	1.74
		Boundary Bay	4	60	22	8.4	3.6	2.1	0.37	1.091	1.98
		Frazer–Pitt	5	59	27	5.9	3.3	2.6	0.46	1.15	1.72
		Oregon	0	—	—	—	—	—	—	—	—
Overall types and areas			36	395	215	20.1	3.6	2.5	0.55	1.23	3.88

Figure 1
Time between encounters with ducks for test hunting parties in the Lower Mainland of British Columbia

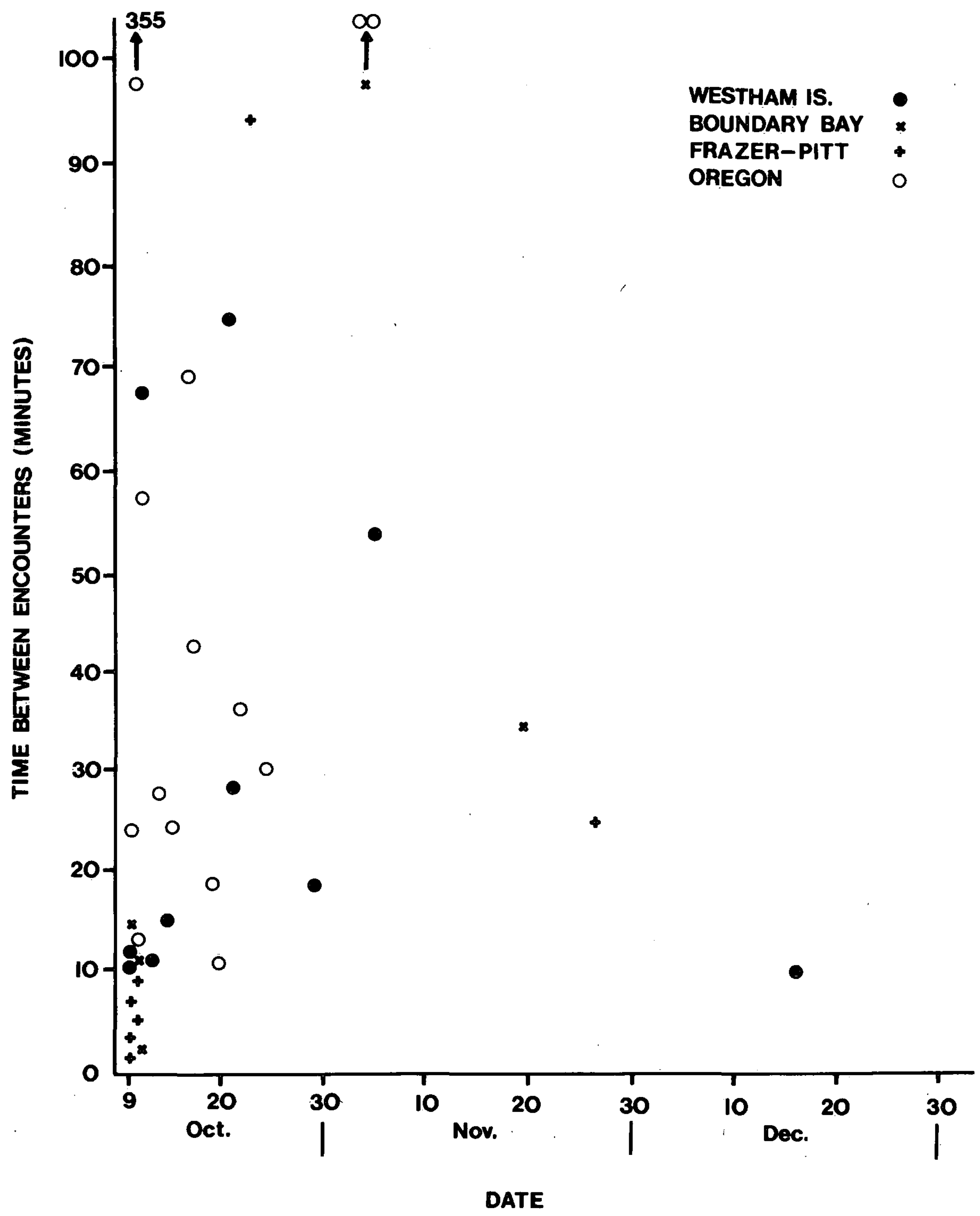

Table 2
Species composition of test hunter encounters and relative success rates (vulnerability)

	Proportion of encounters				Proportion of encounters successful			
	Mallard	Widgeon	Teal	Other	Mallard	Widgeon	Teal	Other
Oregon Coast (decoy)	0.35	0.51	0.01	0.13	0.67	0.73	1.0	0.64
Pass	0.51	0.06	0.28	0.15	0.32	0.5	0.64	0.45
Decoy	0.45	0.41	0.03	0.11	0.53	0.63	0.75	0.70
Total	0.47	0.29	0.11	0.13	0.46	0.62	0.66	0.60

season, as might be expected if hunters became more skillful with practice.

Handling time was quite variable. Decoy hunters generally took about three times as long to retrieve each bird as pass hunters. Handling time for decoy shooting is not clearly defined, since during "hot" periods hunters often leave birds in the water while waiting for more shots. For 156 observations, mean handling time per bird for pass shooters was 1.51 minutes to 2.39 minutes (95 per cent confidence limits).

Over all test hunts, the mean time between encounters was 20 minutes. Considering that about half of these encounters were successful and that usually only one bird was killed in each (average was 1.23 per successful encounter), our hunters killed about one bird for every 40 minutes of hunting time. Since there were usually two hunters per party, the average test hunter killed a bird roughly every hour and a half. For decoy hunts after the opening day, mean time between encounters was twice as great on clear or calm days as on windy days (a similar comparison is not possible for pass shooters, since their success was 0.0 after opening day). The Oregon hunters had similar rates of success, with variation again appearing to be due primarily to weather.

In all cases, overall density of birds in the hunting area appeared to have little effect on time between encounters. Higher success rates on windy days may have been partly due to increased bird movement into sheltered shore areas (where most hunting took place); generally hunters saw more birds in the air on such days. Our observations strongly suggest that almost all birds are completely invulnerable to hunters, except on opening day, owing to generalized avoidance of shorelines and other areas that often conceal hunting parties.

On several occasions, decoy hunters in the Westham Island area experienced higher encounter rates immediately after the appearance in the marsh of other hunting parties. Sporadic scaring up of birds by arriving hunters is probably the reason for our failure to observe any clear difference between early morning and mid day success rates.

Discussion

It would probably not be worthwhile to devote additional effort to measurement of total trip time, handling time, and proportion of encounters successful. Using overall values from this study, the hunter success model becomes:

$$\text{Kill per party per day} = \frac{240}{[1/0.55\ (\text{time betw. encounters}) + 3.9]/1.2}$$

A critical value here is the total time per trip (240 minutes), since any estimate of kill per party will be linearly proportional to it. For an ideal situation, with time between encounters equal to 0 (birds always in range), the model predicts a maximum kill per party of 74 ducks, or about 37 ducks per hunter-day. Such kills would require at least 100 shots for the average hunter. It would be almost impossible to predict maximum kill rate for any single species without some understanding of how and to what extent hunters are selective, since it is necessary to know how many birds of other species would be shot (and use handling time) for each kill of the species of interest.

Since there does not appear to be any simple relationship between time between encounters and bird density or time of season, the model has little value as a predictive tool. Overall abundance of birds may affect opening-day success, but our observations suggest that two- or three-fold changes in bird abundance would have little or no effect on late season hunting unless they were accompanied by changes in bird distribution (i.e., social interaction forcing birds into less favourable but more easily hunted areas). Random factors such as weather and movement of hunters appear to be quite important.

Two further studies, on generalized avoidance learning and on facilitation between hunters, would be especially valuable. Questions which should be asked about avoidance learning include: how many trials does it take, how long does it take for the reaction to extinguish, and how is the learning transmitted from bird to bird? In several situations we observed that shots at a single flock seemed to make other birds more wary; it is also likely that a frightened bird may affect the overall behaviour of any flock that he enters. Klopfer (1957) reported similar observations. Facilitation between hunters might be studied experimentally by deliberately varying the number of hunters allowed into a large marsh or shoreline area. Studies on the rapidity of avoidance learning and hunter facilitation might provide the basis for regulations designed to spread hunting effort more evenly over the season; such regulations would automatically provide a large-scale experimental test of the factors affecting success.

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Species of waterfowl and age and sex ratios of ducks harvested in Canada during the 1972 season

Page 1, authors' names: *For*

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read

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