NEW ZEALAND
MINISTRY OF AGRICULTURE AND FISHERIES

FISHERIES TECHNICAL REPORT

No. 130

VOCAL COMMUNICATION OF THE NEW ZEALAND FUR SEAL ON OPEU BAY ISLANDS, WESTLAND

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WELLINGTON, NEW ZEALAND

1974

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CONTENTS

SUMMARY

Four types of vocalizations of the New Zealand fur seal, Arctocephalus forsteri were recorded at a breeding colony in Westland on the west coast of the South Island of New Zealand.

These included: male threat calls, female threat calls, 2 types of pup attraction calls and pup calls.

Recordings were made on a tape recorder and representative samples were analysed using a Kay spectrograph. Samples of each type of vocalization from 2 individuals are figured.

Length frequencies, harmonisers, energy and duration of each type of call are discussed.

The function of communication in mammals is discussed and responses of other individuals of A. forsteri to each type of call are described.

INTRODUCTION

Despite the large literature on vocalisations in birds and the wide interest attracted by the phenomenon of echolocation in mammals, the role of vocal communication in social behaviour has been analysed in only a few mammalian species (see Tembrock 1963 for a general review of mammalian vocalisations and Marler 1965 for a review of vocalisation in primates).

There are a number of publications discussing the social function of airborne vocal communication within the Pinnipedia. The greatest amount of work has been carried out on the northern fur seal *Callorhinus ursinus* (Bartholomew 1953 and 1959, Bartholomew and Collias 1962, Peterson 1965). Studies of other species include that of Peterson and Bartholomew (1967) on airborne vocal communication in the Californian sea lion *Zalophus californianus* while Le Boeuf and Peterson (1969) have been able to distinguish dialects within the vocalisations of male northern elephant seals *Mirounga argustirostris*.

The most recent work is that by Stirling and Warneke (1971) in which the airborne vocalisations of the two Australian species of the genus *Arctocephalus* (*A. pusillus doriferus* and *A. forsteri*) are used in an attempt to determine the possible evolution and the present taxonomy of the genus.

The work described here is intended as an adjunct to that of Stirling and Warneke to enable comparison between the populations of *Arctoccphalus forsteri* living around the South Australian coast and those living around the coast of New Zealand.

METHODS

The tape recordings used in this study were collected between 25 December 1970 and 12 January 1971 on Taumaka, one of the two Open Bay Islands in South Westland.

The recordings were made using a National R.Q. 501S tape recorder at a speed of 3¾ i.p.s., using a National 200 ohm impedance microphone with a frequency range of 150 to 10,000 H_z. Recordings were made between 0500 hours and 1130 hours as this coincided with low tide. This, in association with the prevailing fine weather, enabled good recordings with the minimum of background noise to be made. The animals were approached as closely as was possible without disturbing them and the tape recorder was set going and left, so that the minimum possible human disturbance was achieved. The behavioural context in which each vocalisation was made was noted from an observation point nearby.

The tape recordings were analysed using a Kay spectrograph and a G.E.C. tape recorder. Care was taken to ensure that the recordings analysed by the spectrograph provided a representative sample from the range available. In each of the figures, samples from two different individuals are shown to illustrate the type of vocalisation being described.

ANALYSIS OF CALLS

1. Male threat calls

From my sonograms it has not been possible to distinguish between the two types of threat calls described by Stirling and Warneke (1971). The threat calls of males which were recorded by me (Fig. 1), appear to correspond to the full threat calls described by Stirling and Warneke for the Australian population of *A. forsteri*.

The threat calls of New Zealand males are characteristically pulsed and contain the major part of their energy below a frequency of 1.75 kH_z. For the first few pulses of this call, the energy seems to be uniformly spread over frequencies below this value, but as the vocalisation progresses there is a 'fading out' of energy below 1.2 kH_z. This situation is comparable to that shown by Stirling and Warneke (Fig. 5d) for the Australian population of *A. forsteri*. In addition, there is a strengthening in the harmonics as the call progresses, a situation also apparent in the sonograms shown by Stirling and Warneke.

2. Female threat calls

This call is similar in nature to the threat call of the adult male A. forsteri (Fig 2).

The call consists of a number of pulses, each being shorter than the one preceding it. The majority of the energy in this call lies in frequencies below 1.0 kH_z. From my sonograms it is not possible to distinguish clear fundamental and harmonic frequencies.

3. Pup attraction calls

The pup attraction call of adult female A. forsteri appears to vary between individuals. Two sonograms made show calls of completely different forms. In the first call the fundamental frequency is at 1.5 kH_z with two clear harmonics at 3.0 and 4.5 kH_z (Fig. 3). The call ends abruptly, and there is a drop in pitch at the end of the call corresponding to a drop in the fundamental frequency. This is in direct contrast with the pup attraction call of another female (Fig. 4) in which the fundamental frequency is 0.15 kH_z with harmonics of 0.3, 0.5, 0.7, 0.8 and 1.0 kH_z. In addition to this very low distribution of energy (the major part of the energy is at frequencies below the fundamental frequency in the first individual's call), the call is pulsed. The fundamental frequency varies in each pulse by 0.01 kH_z but it is continuous. This is in contrast with the harmonic frequencies which are broken at the end of each pulse. Each pulse lasts for 0.1 seconds and although the call ends abruptly, there is no drop in pitch at the end of the call.

Of the twelve individuals for which pup attraction vocalisations were recorded, 10 individudals (83%) had vocalisations which produced a sonogram similar to the first female described here (i.e. high fundamental frequency and no pulsing) and two individuals (17%) had vocalisations which produced sonograms similar to the second type described (lwo frequency and pulsing). Although the number of individuals recorded is too small to be statistically significant, it is interesting to note that at least some female members of the Open Bay Island population vocalize in a manner which has not been described by

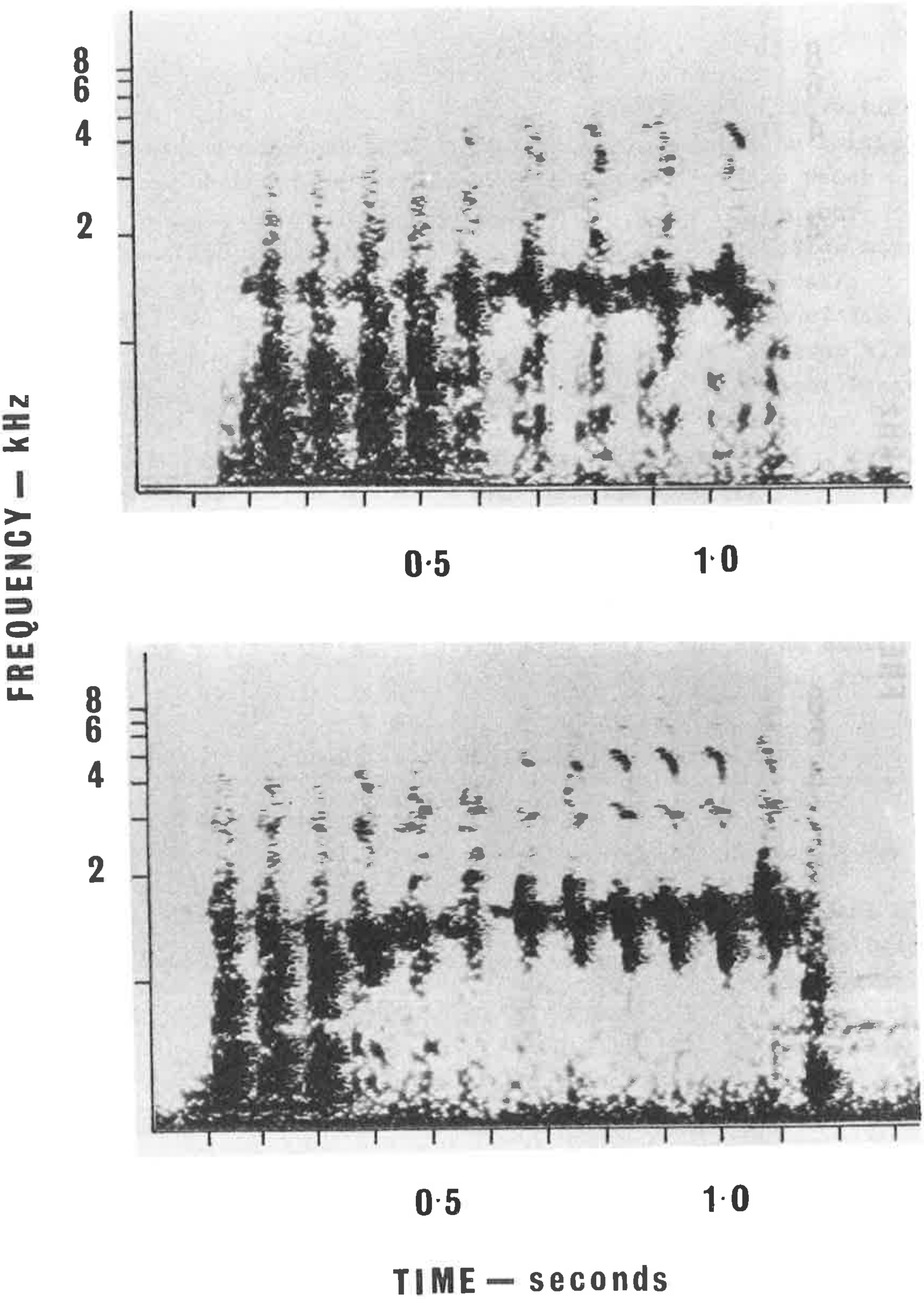

Fig 1. Spectrographs of male threat calls from 2 males

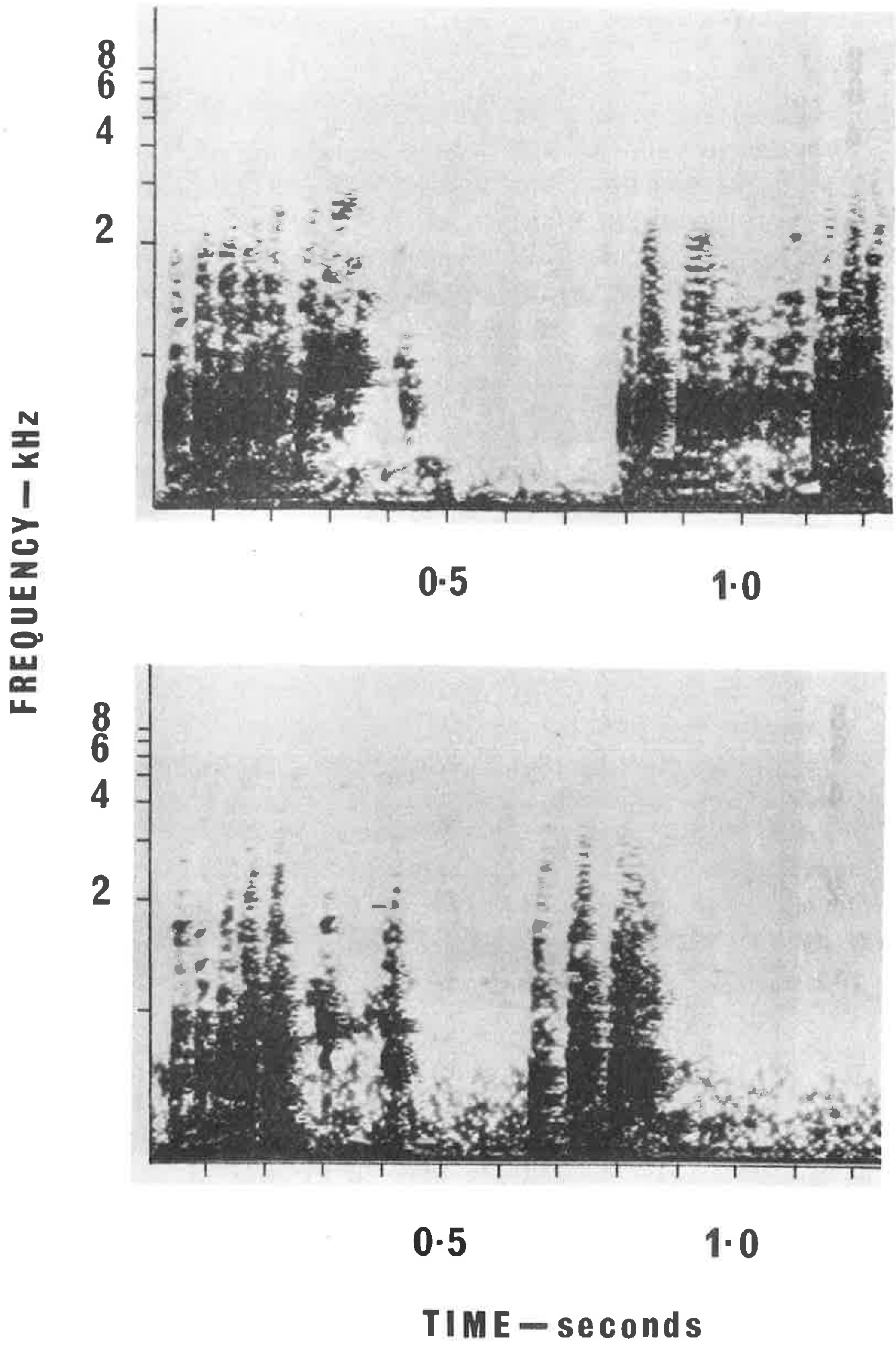

Fig 2. Spectrographs of female threat calls from 2 females

Stirling and Warneke (1971) for the Australian population of *A. forsteri*.

4. Pup call

Pups appear to have one main vocalisation which advertises their whereabouts. The call consists of two parts, an initial vibrant section with a very low fundamental frequency which gives way to a higher sounding section of higher frequency (Fig. 5). The fundamental frequency of the first section may be as low as 0.25 kH_z. In the second section of the call, the fundamental frequency appears to be in the region of 1.6 kH_z. The duration of the call varies but is generally not over 1.5 seconds, the first section of the call having a constant length of 0.5 seconds and the length of the second section being variable.

The first section of the call has six harmonics at 0.75, 1.0, 1.3, 1.6, 2.4 and 2.9 kH_z but these give way to one harmonic of 2.9 kH_z in the second section of the call.

As in the female's pup attraction call, the sound ends abruptly and there is a dropping off of the fundamental frequency at the conclusion of the call.

VOCALIZATIONS AND COMMUNICATION

1. Function of vocalisation

The different forms of sound which are at the disposal of most species are produced only under certain specific biological conditions. Tembrock (1963) differentiated between mechanical sounds which he calls noises and harmonic sounds which are produced by the larynx. Only laryngeal sounds are dealt with here.

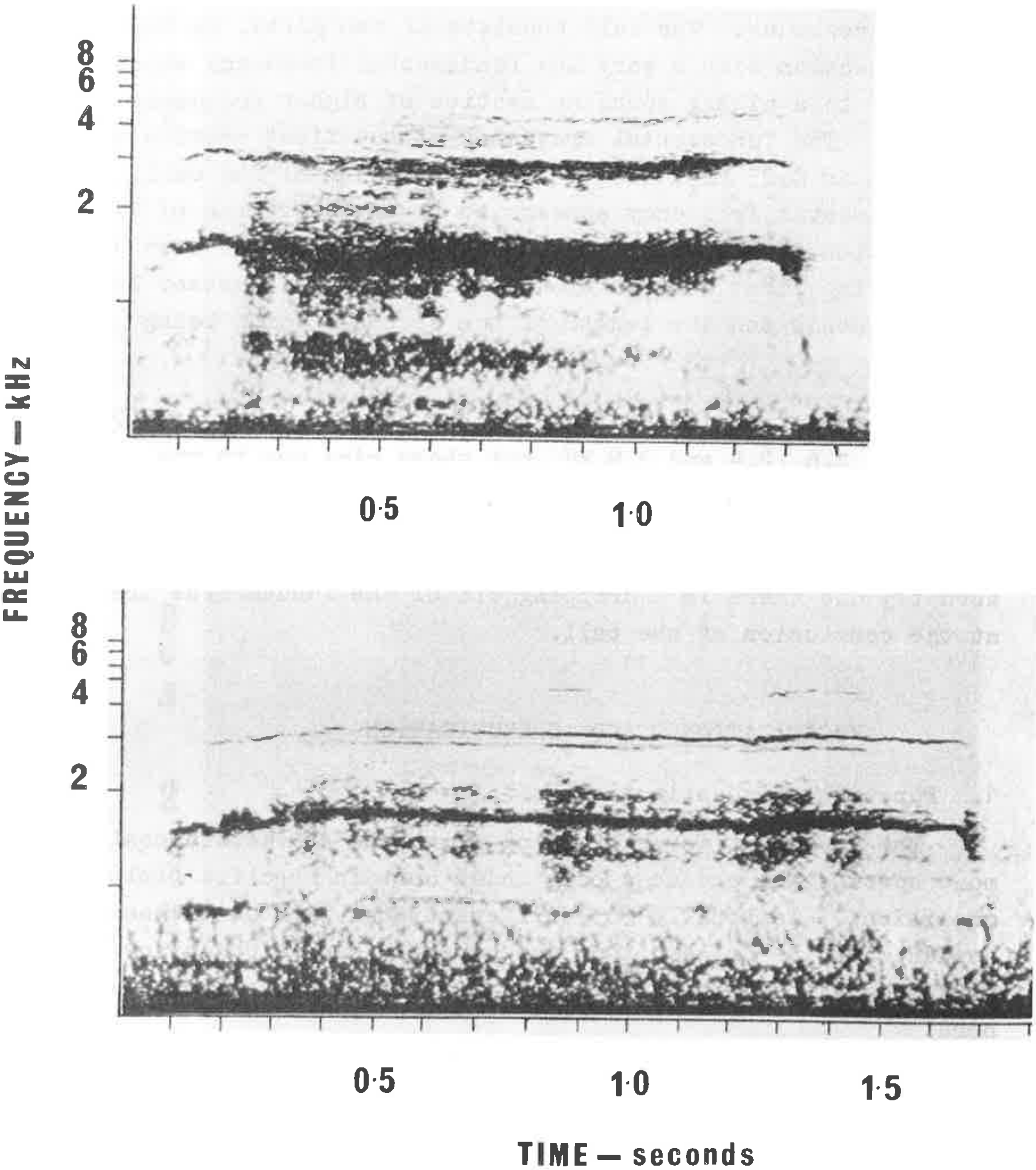

Fig. 3. Spectrographs of pup attraction calls - type one

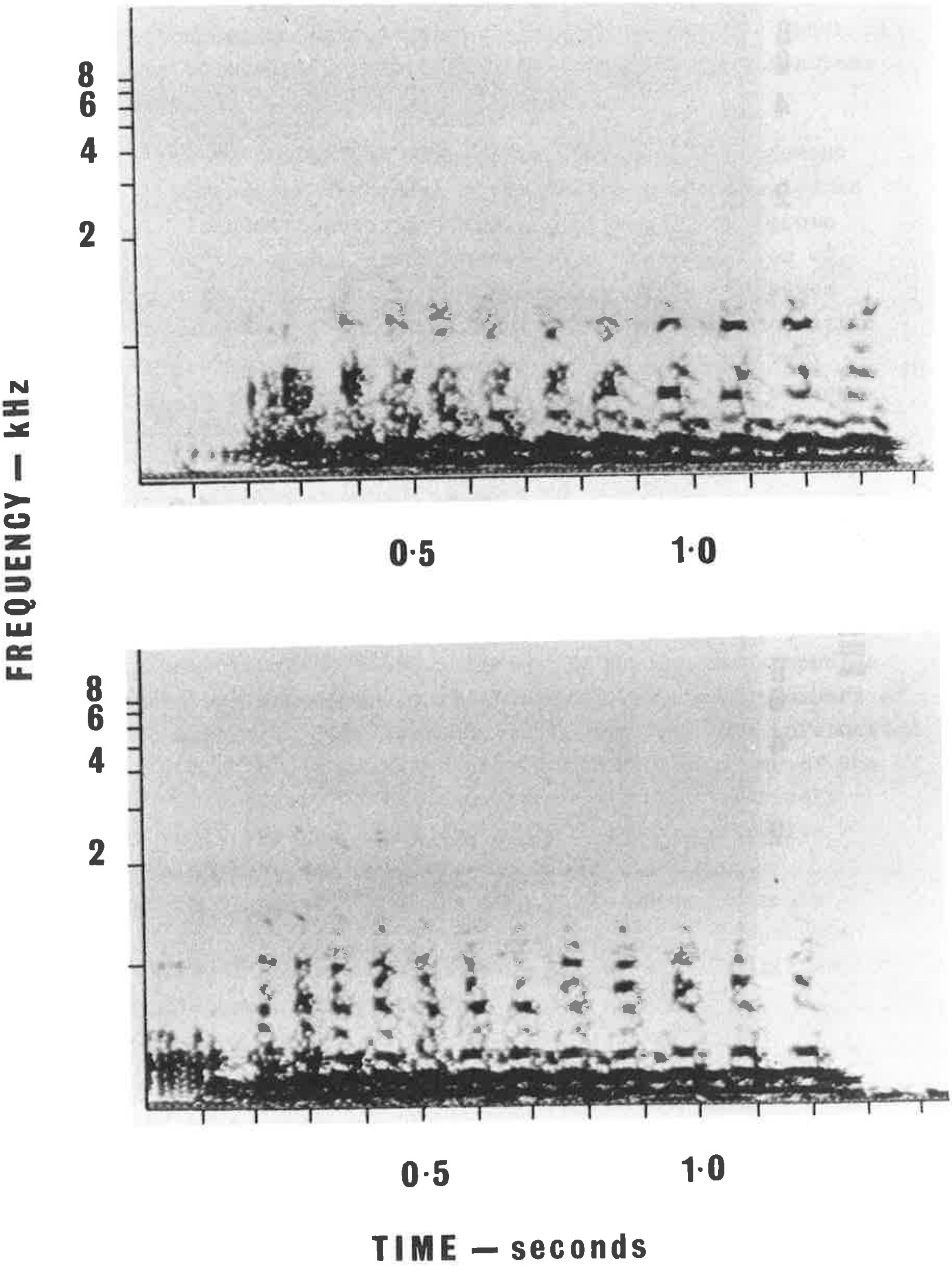

Fig. 4. Spectrographs of pup attraction calls - type two

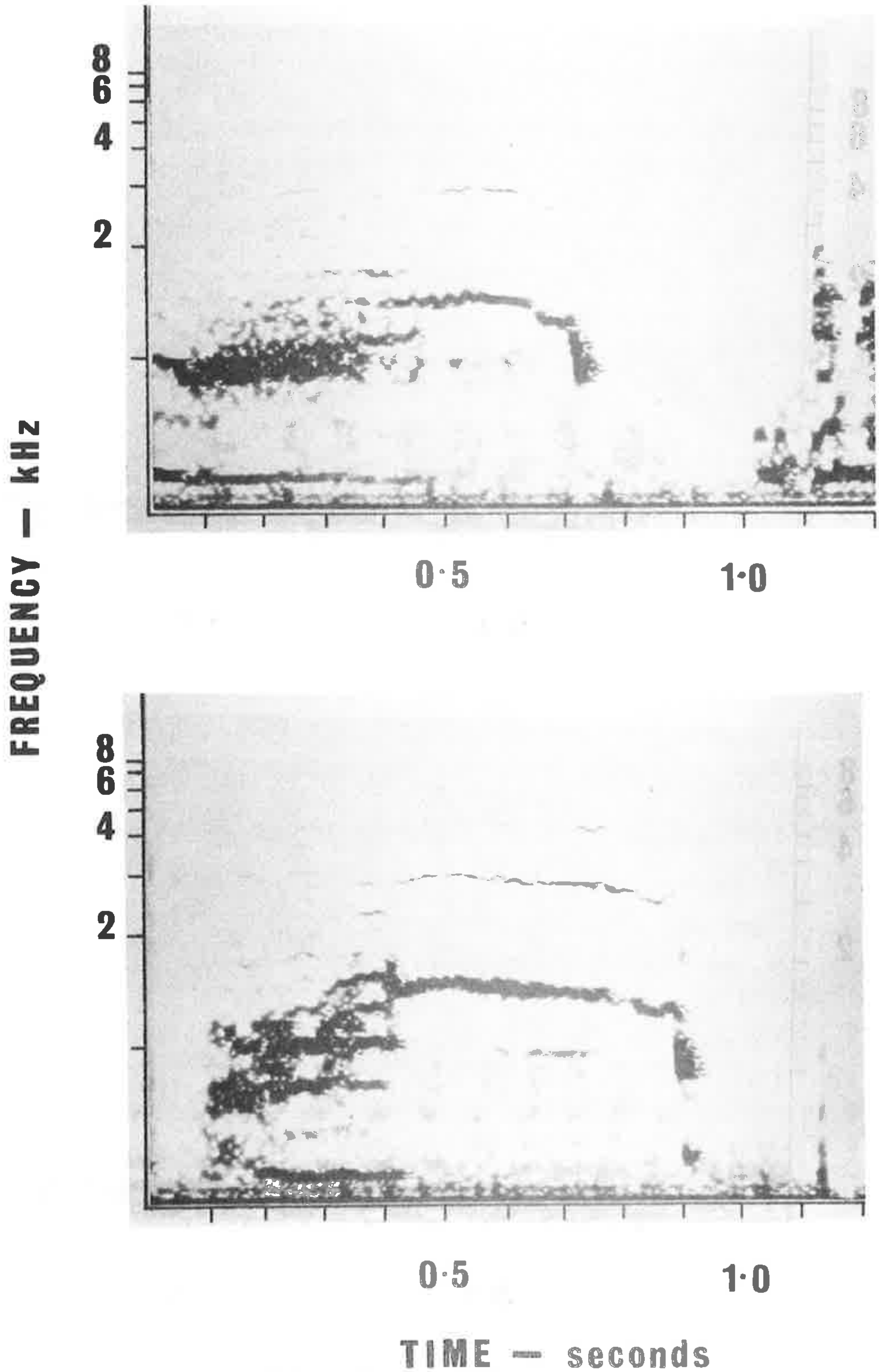

Fig. 5. Spectrographs of pup calls from 2 pups

2. Structure of the pinniped larynx

In the mammalian larynx the most important new acquisition is the thyroid cartilage. This feature, which is exclusive to mammals, permits a wider range of vocalisations to be made.

In the larynx of the Pinnipedia, the poor development or total absence of the vocal cords is the most conspicuous feature. In addition the aryteroid cartilages have grown together at the dorsal end and are fixed in a position of moderate abduction. The adduction of the aryteroid edges which is necessary to produce a loud voice (a characteristic feature of pinniped vocalisations) is effected by a very strong m. thyroarytenoideus. The voice is produced between the upper edges of this single united aryteroid by the inspiratory air current (Keleman 1963).

3. Requirements for effective communication

"Communication involves the evoluation of a synergistic interplay between participants, both of which are committed to maximizing the efficiency of the interchange" (Marler 1967). Relationships such as these can arise across species boundaries but more characteristically they involve members of the same species. This is achieved by encoding the information into a form which is distinguishable by other members of the species. The effect of this in species with a relatively limited vocal repertoire is the evolution of distinctive sounds which have one specific meaning. The basic function of many aural signals is to help animals locate or avoid each other. For ease of location by a respondent to be maximum, the sounds should be broken and repetitive with a wide range of frequencies (Marler 1967).

This situation is clearly demonstrated in pinnipeds. Because of the nature of the physical environmental conditions under which their vocalisations are produced (surf breaking, wind, other animal noises), pinniped vocalisations tend to be characterised by a loud monotonous sound rather than intricate ones such as are found in many bird species. For example, the pup attraction call of the adult female _A_. _forsteri_ is a loud, piercing, highly directional sound. This is as expected as the call is intended as a means of guiding the pup to the female. According to Tembrock (1963) voice contact sounds such as these are primarily to keep the family unit together. They can, however, also be transferred to social groupings of a higher order. Vocalisations of this type are mostly call sequences and are very widespread in the societies of pinnipeds.

4. Responses to vocalisations

The response elicited by a signal is the ultimate consequence of a respondent receiving a given signal. Generally the first response that a human observer may detect is a change in the respondents spatial orientation to the signaller. Only certain classes or types of individuals in the population may respond to a given signal. The communicative roles of different individuals in a population or society are not interchangeable. There may have been selection for much of the signal diversity in animal communication systems as a consequence of the advantages obtained from signals specifying certain classes of respondents.

(a) Responses to male full threat call

The response to this call is limited to male _A. forsteri_. The responses differ, however, between two groups: territorial and non-territorial males.

A territorial male may respond in any one of four ways to a full threat call from an adjacent male. He may:

(a) adopt the alert posture and answer with a full threat call,

(b) adopt the alert posture but not vocalise,

(c) move towards his territorial boundary,

(d) exhibit no response other than opening his eyes, if sleeping.

The responses of non-territorial males to the full threat call of a territorial male depend on whether the individual is on another seal's territory or not. A non-territorial male who is encroaching on the territory of another male responds by adopting the alert posture. Following this, the individual may either move off the territory or challenge the territory holder.

The response of a non-territory holder to the full threat call of a male holding a territory some distance away is usually limited to the adoption of the alert posture.

Frequently males responding to the full threat call of a territorial male adopt alert postures in which their heads are not aligned towards the vocalising individual. This would indicate that the full threat call of the male _A. forsteri_ is not very directional but is intended as a general warning signal.

(b) Response to female threat vocalisation

The response to a threat vocalisation given by a female is not limited to any one age group or class but is elicited in the individual to whom the threat is being made.

Pups or yearling pups threatened by a female move away out of her reach. The vocalisation in this case is often uttered after an attempt by a pup or yearling to suckle from a female other than its mother.

(c) Response to pup attraction call

Response to this call is limited to pups, who respond by uttering the pup call. The response is a general one from pups in the immediate vicinity of the vocaliser. Responses are most commonly, but not invariably, elicited from pups whose mothers are not with them.

The response generally entails the pup giving the pup call and moving towards the vocalising female. As the prime function of this vocalisation is one of location it is not surprising that the vocalisation is repeated a number of times by the emitting female.

(d) Response to pup call

The response to this call, which is emitted by pups only, is limited to nursing females and in some cases to other pups. The most common response to this call is the pup attraction call given by an adjacent nursing female. A vocal exchange between the pup and its mother enables them to locate each other with the minimum of difficulty.

The pup call is to some extent contagious. Other pups hearing this call may answer it with a similar vocalisation, the result being an exchange of vocalisations between pups.

CONCLUSION

Study of the vocalisations of _A. forsteri_ indicates that this species has a limited repertoire of vocalisation but the few calls available to each age and sex class elicit definite responses, thus reducing the need for a wide range of calls.

ACKNOWLEDGMENTS

I wish to thank the Fisheries Management Division, Ministry of Agriculture and Fisheries for financial support, and Dr M.C. Crawley for supervision of the study and criticism of this report.

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