

Chick Rearing at Sea

OFFSHORE DISTRIBUTIONAL PATTERNS, FEEDING HABITS, AND ADULT-CHICK INTERACTIONS OF THE COMMON MURRE IN OREGON

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Abstract. From 1969 to 1973 I observed 1554 Common Murre (*Uria aalge*) chicks at sea during 365 nautical miles (NM) of surveys near Newport, Oregon. Chicks were most abundant within 1.75 NM of a colony but were also observed farther offshore than were unaccompanied adults. Single chicks were unaccompanied by an adult 87 times (10.7%), accompanied by one adult 704 times (86%), and accompanied by two adults 19 times (2.3%). This pattern persisted throughout each breeding season. Seventeen of 18 adults accompanying chicks at sea were males. I determined dive durations of adults (maximum 153 sec), which fed chicks 80.3% (N = 66) of the times they surfaced with prey.

Key Words: Common Murre; *Uria aalge*; Oregon; distribution; parental behavior.

The Common Murre (*Uria aalge*) is one of seven alcid species in which the young leave the nest prior to obtaining full juvenal plumage and go to sea accompanied by adults. I conducted studies to provide additional information on the at-sea behavior, feeding habits, and distribution of adult-chick groups. My objectives were to determine: 1) the type of adult-chick pairing patterns, 2) what seasonal or yearly variations in pairing patterns existed, 3) the sex of the accompanying adults, 4) offshore distributional patterns of juveniles and unaccompanying adults, and 5) feeding habits of adults and young.

MATERIALS AND METHODS

I conducted my studies off Newport, on the central Oregon coast, and at Yaquina Head during May–October, 1969–1973. Transects were run near the breeding colony at Yaquina Head; one ran parallel to shore in water less than 21 m deep and originated off Newport Jetty, 4.5 NM south of Yaquina Head; the other originated 0.25 NM off Yaquina Head in water 20 m deep and ran 10 NM offshore to water 82 m deep. I made other observations of adult-chick groups from a small boat. The transects were surveyed under standard conditions of vessel speed, location, and wind and sea conditions (Scott 1973). I ran transects weekly during the summer months May–August, 1969–1973, and monthly for the remainder of the year, weather permitting. I began the first transect during any given day 3–4 hours after sunrise.

The 11 m Research Boat, *Paiute*, was used during all transects. I observed birds from the right side of the flying bridge, 3.5 m above the water line. All birds observed in a 180° arc around the bow of the vessel were counted and their occurrence noted by 0.25 NM segments. The behavior, direction of flight, group size, and age of each murre sighted were recorded on standardized forms.

The vessel's engine was run at a constant speed of 2200 RPM allowing for a speed of 9 NM under calm sea conditions. The vessel's position was determined

by using a stopwatch, allowing 100 sec for each quarter mile traversed. Compensation for currents, winds, and sea conditions was made by adding or subtracting as much as 10 sec to the elapsed time for each 0.25 NM traversed. The accuracy of these position estimates was verified using radar, reference points on land, and on the offshore transect, a depthmeter at the end of the run. These methods were accurate to within ± 0.25 NM (2.5% error) in a 10 NM run. Runs that deviated more than this were not analyzed.

Weather and sea conditions (wind velocity, chop, fog, swell height) were held within a minimum range of values by the extremely limited weather conditions under which the vessel could run the transects. The effect of glare and possible effects of time of day on the behavior of the birds and my ability to see them were minimized by running the first transect of the day between 4–5 hours after sunrise and by confining surveys to conditions of at least 200 m visibility.

Information on the feeding habits of chicks and their accompanying adults was obtained by direct observations of food items handled at the surface and examination of the contents of the proventriculus of birds collected at sea. Whenever possible, I tried to collect isolated adult-chick pairs to avoid confusion as to which adult was accompanying which chick.

I obtained dive times by observing murres from distances < 50 m. I first located a bird that was sufficiently isolated so that its diving behavior could be monitored without confusion. A timing sequence was always begun with a dive. When the bird initiated a dive, a stopwatch was started and run until the bird emerged. A second stop-watch was used to record the rest period. If a bird surfaced with a prey item, I calculated separate dive-rest ratios for that dive.

RESULTS

Accompanying adults

Chicks accompanied by adults normally swam within 2 m of and behind the adult, calling frequently. During a bout of dives by the adult, the chick would generally swim in the direction the

TABLE 1. YEARLY VARIATION IN THE NUMBER OF ADULT-CHICK COMMON MURRE (*Uria aalge*) GROUPS OBSERVED ON LONGSHORE TRANSECTS OFF YAQUINA HEAD, 1970-1972

	One adult-one chick		Two adults-one chick		One adult-two chicks		Unaccompanied chick	
	N	(%)	N	(%)	N	(%)	N	(%)
1969	450	(84.4)	12	(2.7)	3	(0.6)	68	(12.8)
1970	101	(95.3)	3	(2.8)	0	0	2	(1.9)
1971	103	(83.1)	4	(3.2)	0	0	17	(13.7)
Total	704	(86.6)	19	(2.3)	3	(0.4)	87	(10.7)

adult headed upon submergence and called frequently. When the adult emerged it swam toward the chick and usually the chick reciprocated. Adults seldom emerged at distances more than 75 m away. Pairs were not always reunited before the adult dove again. Adults occasionally gave loud raucous calls, to which the chicks immediately responded by calling and swimming toward the adult.

I observed murre chicks: 1) unaccompanied by an adult, 2) with a single adult, 3) accompanied by two adults, 4) with another chick, and 5) with another chick and a single adult. I occasionally observed two adults associated with a chick. However, when it was possible to observe such groups for 300 sec, one adult always left.

I observed no variation among years in the number of adults (unaccompanied chicks were not included in this test) accompanying chicks ($\chi^2 = 1.78$, $P > 0.776$, $df = 4$), and therefore, combined data from all three years (Tables 1 and 2). Most chicks were observed with a single adult (Table 1). No variation in the type of grouping was observed within a summer ($\chi^2 = 0.471$, $P > 0.925$, $df = 3$).

During July-August, 1969, many murres were found dead on Oregon beaches, including the vicinity of Yaquina Head (Scott et al. 1975). The percentage of chicks observed without an accompanying adult was significantly different among

years ($\chi^2 = 83.39$, $P < 0.001$) with the number in 1969 being greater than 1970 ($\chi^2 = 8.65$, $P < 0.005$) but not significantly different from that observed in 1971 ($\chi^2 = 0.0029$, $P > 0.950$).

Sex of adult accompanying chicks

I collected 18 adult-chick groups at sea. In all but one of these groups, the accompanying adult was a male ($P < 0.005$). In one group that consisted of two adults and one chick, only one of the adults collected was a female. The weight of the chick was 653 grams or 66.8% of the accompanying female's weight (977 g). Other chicks collected that same day weighed 302, 780, and 893 grams, suggesting that the chick was not a late fledging bird (see Discussion).

Weight of accompanied chicks at sea

Common Murre chicks that I judged to be 75% or more of adult size were frequently accompanied by adults. Four of 15 juvenile birds collected while accompanied by adults weighed 800 g or more. One juvenile still accompanied by an adult had obtained a weight equal to that of the accompanying adult.

Diving behavior

I observed adult Common Murres making dives as long as 154 s and one series of dives lasted 118 min (Table 3).

TABLE 2. COMPOSITION AND OCCURRENCE OF 629 ADULT-CHICK COMMON MURRE (*Uria aalge*) GROUPS DURING THE FOUR 2-WEEK PERIODS FOLLOWING THE OBSERVATION OF THE FIRST ADULT-CHICK GROUP AT SEA. DATA ARE ONLY FROM FIRST TRANSECT OF THE DAY TO AVOID DUPLICATE COUNTS. THESE DATA ARE FROM TRANSECTS RUN 4.5 MILES LONGSHORE OR 10 MILES OFFSHORE OF YAQUINA HEAD, OREGON (1970-1972)

	30 June to 14 July	15 July to 29 July	30 July to 12 Aug.	13 Aug. to 26 Aug.
Nautical miles surveyed	30	60	60	35
No. of adult-chick groups observed ¹	46	239	142	202
Percent of groups having one adult and one chick	97.7	96.9	99.1	95.3
Total adults observed on the water	304	616	343	284
Percent of adults associated with chick	15.1	38.8	41.4	71.1
Adults/transect/mile	10.1	10.3	5.7	8.1
Unaccompanied adults per mile	8.7	6.3	3.4	2.3

¹ Unaccompanied chicks are included in this category and assumed to be accompanied by one adult.

TABLE 3. DIVE/REST SEQUENCES OF ADULT COMMON MURRES (*Uria aalge*) ACCOMPANIED BY CHICKS IN WATER THAT WAS AT LEAST 40 METERS DEEP. ONLY DIVE/REST SEQUENCES WITH MORE THAN 3 DIVES DURING WHICH THE BIRD DID NOT HANDLE PREY ITEMS

	N	Duration (s)		95% C.I.
		\bar{X}	SD	
Dives after which prey handled at surface				
Dive	50	104.1	32.9	94.8–113.4
Rest	50	56.8	27.1	49.1–64.5
Dive/rest ratio	50	2.1	1.1	1.82–2.42
Dives after which prey not handled				
Dive	137	100.6	36.4	94.4–106.8
Rest	137	44.5	26.7	39.9–49.1
Dive/rest ratio	137	3.0	2.2	2.63–3.39

I observed adult–chick groups for 1023 min. During this period 242 dives were made by adult birds and six by chicks. One hundred fifty-four (82.4%) of the dives were 100 sec or longer (Table 3). Prey items were handled at the surface immediately following 66 of the 242 dives by adults (27.3%). On 53 of these occasions (80.3%) the chick was fed by the adult. I observed only one chick capture food. The longest dive by a chick was 30 s (range 18.7–30), and I observed no chick make more than 3 consecutive dives.

The average dive time for accompanied adult murres on dives in which prey was handled at the surface was 104.1 sec, while those for dives in which prey was not handled at the surface averaged 100.6 sec (Table 3).

Feeding habits

Of 60 food items observed being fed to chicks at sea, 31 were items too small to be identified. The identified items ranged from flatfish to anchovies.

Comparison of food items taken by adult murres accompanying chicks and those unaccompanied by chicks collected at the same time shows that juvenile rockfish (*Sebastes* sp.) were a more important part of the diet for unaccompanied adults than accompanied adults (Table 4). One murre chick had an empty stomach, while the accompanying adult had large numbers of euphausiids.

The prey items eaten by chicks did not differ significantly in size from those eaten by their accompanying adults (Table 5). Small unidentifiable food items were observed being fed to young murres by adults at sea on several occasions but no organisms of appropriate size were found in the analysis of stomach contents. As

TABLE 4. INDICES OF RELATIVE IMPORTANCE (SANGER AND JONES 1984) (0–99 = LOW IMPORTANCE, 100–999 = MEDIUM IMPORTANCE, 1000–9999 = HIGH IMPORTANCE) OF VERTEBRATE PREY ITEMS TAKEN BY JUVENILE MURRES ACCOMPANYING ADULTS AND ADULT MURRES UNACCOMPANIED BY JUVENILES COLLECTED AT THE SAME TIME. BIRDS WERE COLLECTED DURING JULY AND AUGUST OF 1970, 1971, AND 1972

Prey item	Adult/chick groups		Unaccompanied adults (N = 11)
	Adults (N = 7)	Juveniles (N = 9)	
Fish			
Engraulidae	2269	5591	1615
Osmeridae	100	—	—
Scorpaenidae (except <i>Sebastes</i>)	1536	309	448
<i>Sebastes</i>	4654	2625	537
Ammodytidae	100	—	555
Anoplopomatidae	—	36	—
Unidentified fishes	227	1064	37

gauged by Sanger and Jones' (1984) Index of Relative Importance, Scorpaenidae are the most important food item for all groups followed by Engraulidae with other taxonomic groups of minor importance. Some differences among groups were noted (Table 4) with chicks feeding more on anchovies than did their accompanying adults or unaccompanied adults. No differences in prey size taken could be determined with the possible exception that unaccompanied adults may feed on smaller rockfish (Table 5).

Chicks at sea

I compared the occurrence of chicks within quarter-mile segments for the first 4 nautical miles offshore (west) and longshore (south) off the Yaquina Head breeding colony. These transects were run daily within one hour of each other. Although there were more adult–chick groups observed on the offshore transect than on the longshore one (156 vs. 102), a larger percentage and number of these were found within 1.8 NM of Yaquina Head on the offshore transect (Fig. 1), and I found more adult–chick groups at distances greater than 2 NM longshore than were found at these same distances offshore ($\chi^2 = 13.41$, $P < 0.005$).

Both the number and percentage of adults on the water that were part of adult–chick groupings increased following the first observation of chicks at sea (Table 2). At the same time, the number of murres/NM observed on the water remained relatively constant through the first two 2-week periods. The number of adults unaccompanied by chicks declined during this same time period,

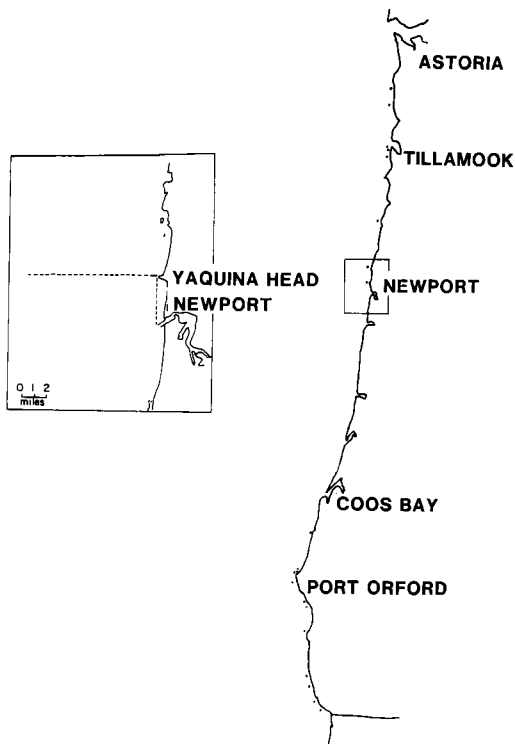


FIGURE 1. Study area in relation to other major breeding sites (designated by dots offshore) for Common Murres in Oregon. The dotted lines on the insert show the two major transect lines. The line running from the North Newport Jetty to Yaquina Head is the longshore transect and the line extending west from Yaquina Head depicts the offshore transect.

suggesting unaccompanied adults leave the area to forage in areas further from Yaquina Head.

Adults accompanied by chicks occurred significantly farther offshore ($\bar{X} = 3.9$ NM, $SD = 2.7$, $N = 551$) than unaccompanied adults seen on the water ($\bar{X} = 2.9$, $SD = 2.5$, $N = 453$) for birds observed on transects run within 10 NM of the beach.

Eighty-two percent of the adult-chick groups ($N = 167$) I observed during transects run more than 40 NM offshore were found within 10 NM and 97.6% within 20 NM of the Newport Jetty (Fig. 2).

Adult-chick groups have been observed in Alsea Bay and in Siuslaw Bay 28.6, 15.4 and 29.8 NM south and 78.5 and 55.7 NM north of the nearest Common Murre colonies (Wayne Hoffman, pers. comm.). The greatest distance offshore I found a chick was 36 NM.

DISCUSSION

Chicks at sea

Common Murre chicks were most frequently found offshore with a single adult male. Like Varoujean et al. (1979) and others (Gaston and Nettleship 1981), I found that chicks are normally accompanied offshore by just one adult, a male. The number of adults accompanying a chick did not vary seasonally or yearly. This lack of variation is the same as found by Varoujean et al. (1979) and Birkhead (1976) for Common Murres and Harris and Birkhead (1985) for Thick-billed Murres. Storer (1952:141) reported for central California populations that "after the breeding season they are to be seen in family

TABLE 5. COMPARISON OF THE SIZE (CM FORK LENGTH FOR FISH TOTAL LENGTH FOR INVERTEBRATES) OF PREY ITEMS FOUND IN COMMON MURRE (*Uria aalge*) CHICKS, ACCOMPANYING ADULTS AND ADULT MURRES UNACCOMPANIED BY CHICKS COLLECTED AT THE SAME TIME JUNE-AUGUST (1970-1972) NEAR NEWPORT, OREGON

Prey item	Murre chicks		Accompanying adult		Unaccompanied adult	
	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$	N	$\bar{X} \pm SE$	N
Crustacea						
Mysids			1.3 \pm 0.20	(13)	0.08 ¹	(59)
Euphausiidae					0.68 ¹	(550)
<i>Thysanoessa spinifera</i>					0.5 \pm 0.04	(14)
Osteichthyes						
Clupeida			9.3	(2)		
Engraulidae	10.2 \pm 1.5	(10)	10.6 \pm 2.0	(3)	13.0	(2)
Osmeridae			6.0	(1)		
Scorpaenidae						
(except <i>Sebastes</i>)	6.1 \pm 0.4	(11)	5.8 \pm 0.6	(10)	5.5 \pm 0.42	(19)
<i>Sebastes</i>	5.12 \pm 0.7	(5)	5.7 \pm 0.6	(17)	3.9 \pm 0.2	(20)
Cottidae	5.4 \pm 0.3	(5)				
Ammodytidae			9.2	(1)		
Anoplopomatidae					5.9	(1)
Unidentified fish		(1)				

¹ Average volume in cm³.

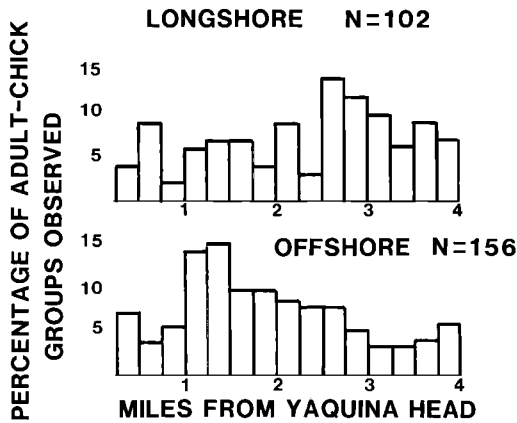


FIGURE 2. Occurrence of adult-chick groups observed during transects run alongshore and offshore of Yaquina Head.

groups of three—two parents and one young—until about late August, after which time the young is usually convoyed by one parent.” However, more recently he has indicated (pers. comm.) that the statement that two adults accompany a chick immediately after leaving the nest was based on statements in Bent (1919) and was not substantiated by his own field studies.

Uspenski (1958:54) indicates that one adult Thick-billed Murre of either sex usually accompanies a chick to sea. However, he also stated “that usually only one parent is engaged in finding food for the chick.” He observed that in September and October flocks were observed in multiples of three “indicating that families (two adults and one young) have not broken up by that time.

The sighting of single chicks (less than $\frac{3}{4}$ adult size) probably resulted from the accompanying adult being submerged at the time of observation, although a small percentage of these might have been orphaned. The large percentage of unaccompanied murre chicks in 1969 may have been due to an increase in orphaned chicks. An alternative explanation is that, as a result of lower food availability, the adults were foraging a greater percentage of the time and were simply less visible. The percentage of birds collected with empty stomachs in 1971 was intermediate (48.4%) between the figures for 1969 (75.0%) and 1970 (26.9%). This may be indicative of a moderately poor food year. If so, this could explain the similarity in the nature of adult-chick groupings in 1969 and 1971.

Sex of accompanying adult

My finding that in 17 of 18 cases the male accompanied the chick offshore contradicts

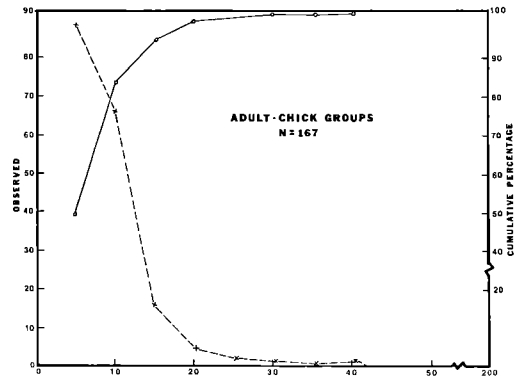


FIGURE 3. Number and distribution of Common Murres observed during transects extending at least 50 miles offshore of Oregon. Data are taken from six different cruises.

Tuck's (1961:164) statement that either sex may accompany the chick out to sea. However, Tuck (pers. comm.) indicated that, “of the 20 adults that I collected accompanying chicks, 16 or 17 were males.” The only females collected were taken toward the end of the seagoing period and were accompanying late fledging young.

An advantage to having a single adult accompany a chick offshore is that it reduces the number of birds foraging in the immediate area of the breeding colony. These reductions in density could be achieved by a long as well as an offshore dispersal of adult-chick pairs.

I found no evidence to suggest seasonal or yearly variation in the number and sex of adults accompanying chicks at sea. If there is variation in the number and sex of adults accompanying chicks at sea and in other areas, then the question arises as to what factor or factors determine the number and sex of the accompanying adult(s). Food availability has been suggested as a key factor in the evolution of precociality in the alcids (Lack 1968). It could be postulated that two adults would accompany a chick offshore during poor food years to maximize chances of the young surviving. If this is so, then the number of adults accompanying a chick should vary with the availability of food. As stated earlier, I found no evidence for this in my study area nor in the literature.

Dispersal from the breeding colony

The distribution of adult-chick groups at sea off Yaquina Head, Oregon, is primarily restricted to waters within 15 NM of the beach (85% of groups observed). The number of murres observed within 10 NM of the Yaquina Head breeding colony decreased 2 weeks after the first

chick fledged. The dispersal appears to be more longshore rather than the offshore pattern suggested by Cody (1973:37). He argued that "the inshore zones are much more heavily fished than the offshore areas and thus the chicks could be moved to more profitable sites if food is equally available over larger and more distant areas." The water depth of Yaquina Head, Oregon, increases to 66 m at 5 NM, 80 m at 10 NM and 99 m at 15 NM. Additionally, the number of anchovy likely decreases with increasing distance offshore (Blaxter 1967).

The coastal area is where feeding opportunities might be expected to be the greatest. Anchovies are found in large numbers in shallow inshore waters (Blaxter 1967), and the water is shallow enough so that murrelets can feed on fish living at or immediately above the bottom, something they might not be able to do regularly in deeper water. Furthermore, the deeper the water, the greater the volume in which a school of fish and other prey can hide, and in deeper water a school might escape predation by swimming to depths beyond the diving capability of the murre. Studies of the distribution and abundance of murrelets and their principal prey species at sea in areas with different physical and biological resources are needed to determine if feeding opportunities are greater in coastal areas.

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