

# THE DISTRIBUTION OF BULLER'S SHEARWATER (*Puffinus bulleri*) IN THE NORTH PACIFIC OCEAN

by T. R. WAHL

## ABSTRACT

From available records ranging from systematic surveys to casual observations, the known distribution of Buller's Shearwater in the North Pacific Ocean is described. The birds arrive in subarctic waters in June and slowly expand northward and eastward as far as the Gulf of Alaska by August. The mid-ocean distribution after August is poorly known, but many birds, presumably non-breeders, are along the west coast of North America, at least from British Columbia to southern California, until late October-early November. Numbers observed along this coast have increased since the mid-1960s.

Although Buller's Shearwater has been known to occur in the North Pacific since at least 1900 (Loomis 1900), only in recent decades has a general pattern of its distribution become clear. In this paper I have summarised recent records that report the species over almost all of the subarctic North Pacific, including northern Japan, southern Kurile Islands, Kodiak and the northeastern Gulf of Alaska, British Columbia, the west coast of the United States, and in mid-ocean. I am unaware of reports from the Sea of Japan, Sea of Okhotsk and the Bering Sea.

Records from mid-ocean were obtained through systematic observations from research vessels. Figure 1 shows some features of the subarctic North Pacific Ocean. Figure 2 shows the tracks of six cruises I made. Data from one cruise made by DeGange (1979) in the northwestern Pacific are included. Data from these sources, while representing some 4000 individual censuses, is only a minimal sampling and limited mainly to the months of June-August. In addition, all other published records for the area are included, including records from Japan and adjacent waters judged valid by Nakamura & Hasegawa (1979).

Figures 3-5 show, for most of the North Pacific, including the Gulf of Alaska, total numbers observed by five degree latitude and longitude "blocks". Census effort is not comparable between blocks. The figures do not represent density (birds/area surveyed) and cannot be used to compare total numbers found in mid-ocean directly with numbers found in coastal areas.

The records from the waters off the west coast of North America, south of Alaska (see Figure 6), are mostly totals from one-day bird-watching boat trips reported in the seasonal summaries published in *Audubon Field Notes/American Birds*. Reports in these seasonal summaries seldom relate observations to effort and usually omit days when no Buller's were seen, but they give important information. Fortunately, Buller's Shearwater is a species of interest on bird-watching trips and published trip reports include most records, except

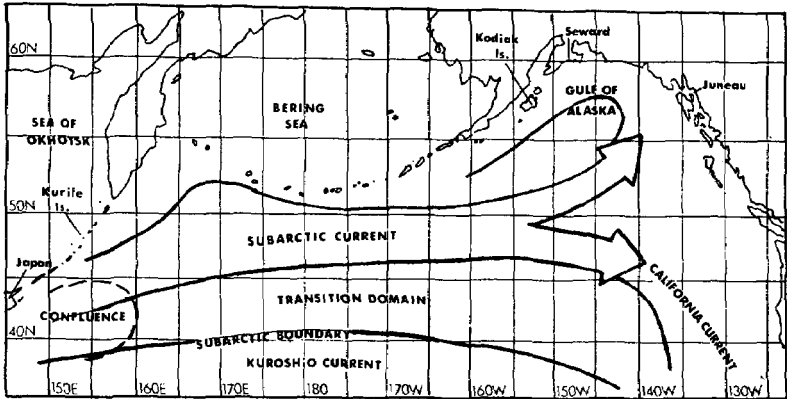


FIGURE 1 — Subarctic North Pacific Ocean, showing some oceanographic features (after Favorite *et al.* 1976)

that summaries for Monterey Bay often give only early and late dates, or unusual numbers and occurrences. Because methods of observation were not standardised and the 100+ reports available cannot be statistically treated, I have used from the 1971–1983 records the largest number reported in each geographic subregion (Figure 4) by month in Table 1 and year in Table 2. The results are a simple analysis that corresponds in year with the beginning of regular offshore trips and other field work and represents a large proportion of all records of Buller's Shearwater in the North Pacific. Data from this part of the North American west coast offer some insights on month-to-month and year-to-year variations and so I have kept this separate from data from the western and mid-North Pacific. I have also included data from research cruises from California (Briggs *et al.* 1978; Tyler *et al.* 1982) and Washington (Wahl 1975 and unpub.)

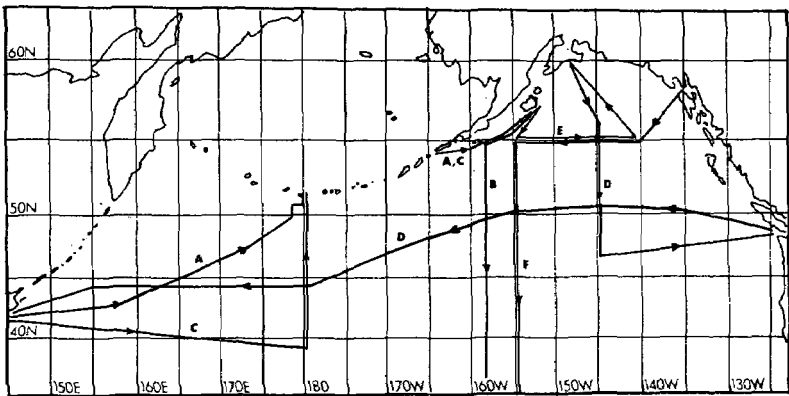


FIGURE 2 — Cruise tracks. A — Japan to Kodiak, June–July 1975. B — Kodiak to Hawaii, October–November 1976. C — Japan to Kodiak, June–July 1980. D — Seward, Alaska, to Seattle to Japan, July–August 1981. E — Kodiak to Seward, July 1983. F — Juneau, Alaska, to Hawaii, July–August 1984.



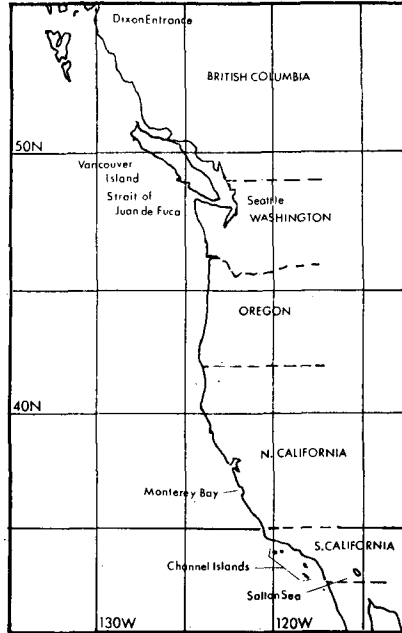


FIGURE 6 — West Coast of North America

### SEASONAL DISTRIBUTION

*June:* Apart from one record of three birds near Kodiak in April (Kessel & Gibson 1978) and five off Southern California in May (Briggs *et al.* 1978), the earliest records of any widespread numbers of Buller's Shearwaters appear to be in June (Figure 3) when, north of the subarctic boundary in mid-Pacific (in the Transition Domain: see Figure 1 and Favorite *et al.* 1976), I recorded birds in June 1980 and C. Bouchet (pers. comm.) reported them in June 1981. Flocks of 10-50 birds were resting on the surface and often flushed by the vessel. No obvious migration was noted. Nakamura (pers. comm.) believes that distribution off Japan relates to the Kuroshio-Oyashio Confluence and that no birds occur within the warm waters of the Kuroshio Current itself during the northern summer, after migration across the tropics is largely completed. Sleptsov (1960) described this shearwater as fairly widespread in the northwest Pacific "from 30°34'N, 150°11'E to 46°15'N, 160°15'E" but did not give month or season.

In the eastern Pacific, the only records are of 17 birds in mid Gulf of Alaska in 1976 (Kessel & Gibson 1978) and one bird off Southern California in June 1976 (McCaskie 1978).

*July:* Birds apparently move northward in July in the western Pacific (Figure 4). While little is known from mid-Pacific in June and July owing to lack of observations, we can only speculate that many birds move to the east along the Subarctic Current. I saw no Buller's Shearwaters while crossing

the Gulf of Alaska in 1983. In 1984 I crossed the Gulf of Alaska again and then went south to Hawaii on 155°W. Small numbers of Buller's were seen between 44° and 47°N. Thus, Figure 4 indicates scarcity in the open northeastern Pacific and Table 1 shows only two other July records: three birds seen near San Francisco (Remsen & Gaines 1973) and birds seen daily during the first ten days of July 1971 between Kyoquot and Cape Cook, Vancouver Island (Guiguet 1971). Records in the northeastern Pacific before August are few.

*August:* In August, birds are known from almost all across the North Pacific (Figure 5), apparently having followed the Subarctic Current (and one of its extensions, the California Current) eastward. Shepard (in Guzman & Myres 1983) reported Buller's Shearwaters "on most days" on a cruise from Japan to Vancouver BC in late August 1968, with the largest number, about 100, seen off the Strait of Juan de Fuca. A flock of over 200 were recorded at Ocean Station 'P', 50°N, 145°W on 27 August 1969 (Gruchy *et al.* 1971). As breeding birds appear in New Zealand in September (Jenkins 1974), August is probably the month of most widespread distribution in the Northern Hemisphere. Although observers have been in the Gulf of Alaska in August, no Buller's Shearwaters have been reported north of Ocean Station 'P'. The birds seen there in April and June may have been vagrants associated with oceanographic variations — they are normally distributed further south. In August, birds also appear along the west coast of North America (Table 1). There is a record for British Columbia on 7 August 1926 (Nichols *in* Godfrey 1966) which has been discounted in the past, apparently for lack of a specimen. Flocks of birds occur off Washington and Oregon in August. At least 183 birds were reported off Monterey Bay, California, in August 1970. A flock of 1300 off the Channel Islands, Southern California, in 1976 (Briggs *et al.* 1978), seen during surveys done further offshore than previously, may represent a relatively regular occurrence, perhaps of breeding birds about to leave on southwestward migration (see Ainley 1976). An interesting record is of a bird captured alive at the Salton Sea, Southern California, about 125 km inland, on 6 August 1966 (McCaskie 1966). Oceanic birds observed here may be more likely come from the Sea of Cortez, Mexico, than from over a mountain range directly from the Pacific Ocean proper.

TABLE 1 — Maximum numbers (largest sighting reported) per month, all years combined, 1970-1982

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
British Columbia							+		10	93	1	
Washington		1						37	1183	1232		6
Oregon								150	50			1
Northern California*		1	1				1	183	2000	750	3	1
Southern California			1		5	1		1300	2000	2	3	

\* Almost all reports from San Francisco - Monterey Bay area

TABLE 2 — Maximum numbers (largest sighting reported) per region per year, 1971-1983

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
British Columbia	Too few data												
Washington	150	509	870	178	207	1232	937	129	33	24	14	14	71
Oregon	Too few data												
Northern California*	400	20	400	750	600	1	1		1	75A	15A	2000	B
Southern California	2		2	1	12	2000	5		3	3		4	8

\* Almost all reports from San Francisco - Monterey Bay area

A Also recorded offshore by Briggs et al, but numbers not given

B "lower than normal"

*September:* Buller's Shearwater has not been reported mid-ocean in September — no observations have been conducted then. There are, however, records of it off the Kuriles (see Nakamura & Hasegawa 1979), in the northern Gulf of Alaska (Wohl 1975, Kessel & Gibson 1978) and at 50°N, 145°W mostly between 10 and 27 September (Guzman & Myres 1973). As breeding birds would have withdrawn to the south (see Jenkins 1974), the birds may be scarce over much of the North Pacific in September, with non-breeders remaining in areas of rich feeding. However, Table 1 shows that this is a month of peak occurrence along the west coast of North America. Many birds are still present in numbers through October, and these are presumably non-breeders, feeding over the continental shelf without any urgency to migrate directly across the tropics to New Zealand. The 2000 birds seen off San Miguel Island (Channel Islands) on 26 September 1976 (McCaskie 1977) is a very large number for Southern California, where numbers are normally low (see Garrett & Dunn 1981) compared with Northern California and Washington.

*October:* Birds continue to be observed off the North American west coast in October, with maximum numbers about the same as, or higher than, those reported in September (Table 1). Before 1982, when 2000 birds were reported on 22 September in Monterey Bay (LeValley & Roberson 1983), the highest counts for each year in Northern California occurred in October (e.g. DeSante *et al.* 1972). The only October record from elsewhere in the North Pacific is of two birds off northern Honshu, Japan (see Nakamura & Hasegawa 1979). On a research cruise from Kodiak to Hawaii in late October-early November 1976 along 158°W, I did not record any Buller's Shearwaters. Thus, the main North Pacific concentration during September and October is probably along the North American west coast.

*November-February:* I am aware of only eight records for Buller's Shearwaters in November, all along the west coast of North America (Table 1), where observation effort is relatively higher than in other regions. The British Columbia record is for Dixon Entrance (Crowell & Nehls 1972). Two records were off Washington (see Hunn & Mattocks 1983), one was of three

birds in Monterey Bay (DeSante *et al.* 1972) and, as might be expected, four records were concentrated at the south, off Southern California (McCaskie 1970, 1980, 1981), including one bird in 1957 (Garrett & Dunn 1981). Single birds have been seen in December off Oregon (Hunn & Mattocks 1983) and Monterey (Stallcup & Winter 1976) and one possible was reported off Point Pinos, near Monterey Bay (LeValley & Evens 1982). Single dead birds have been found in January in Washington (Hunn & Mattocks 1983), and in February in Northern California (Stallcup & Winter 1976) and Southern California (McCaskie 1976). Observation efforts continue through the winter months off California, and so the few records there indicate that the species is rare after November.

### HISTORICAL TRENDS

*Population changes:* In addition to the earlier records given above, we have California records given in Loomis (1918), the first record for Washington in 1931 (Jewett *et al.* 1953) and for Oregon in 1932 (Gabrielson & Jewett 1970). Although the species was apparently seen quite consistently near Monterey Bay through the years, very few occurred before the early 1960s at other locations. Sleptsov (1960) and Kuroda (1955) took early specimens in the northwestern Pacific, but other observers did not report this rather distinctive species: Hamilton (1958) crossed from Japan to Washington in June 1955, Sanger (1965, 1972) spent considerable time off the Washington and Oregon coasts and farther offshore, and Martin (Martin & Myres 1969) observed other birds but reported no Buller's Shearwaters while fishing off British Columbia and Washington from May to September 1946-1949. Although observation effort offshore along the continents and in mid-ocean before the 1960s was much lower than after about 1970, the few Buller's Shearwaters reported by these observers suggests lower numbers were present then than recently.

*Annual numbers:* Variations are unknown for most of the North Pacific and this will remain so unless much greater survey effort is possible. However, existing records give some idea of changes in numbers observed along the west coast of North America. Table 2 gives the single largest records per year for the three areas where reports of observations have been consistent — Washington, Northern California and Southern California. By this simplified means, we can see that numbers do vary. Before 1971, numbers were low until 1966, when up to 225 were seen in Monterey Bay (Paxton & Chandik 1967). In 1967, 300 were reported off Northern California (Chandik & Baldrige 1968) and the maximum count in 1968 was 175 off Southern California (McCaskie 1969). In 1969, the maximum count was four birds at Monterey (Baldrige *et al.* 1970). In 1970, a maximum of 700 was seen off Northern California (Chandik *et al.* 1971). Then, from 1971 on, numbers were relatively high through 1975 in Northern California and through 1977 in Washington. The large numbers of birds off Southern California in 1976 (McCaskie 1977) were seen during unusually thorough surveys off the Channel Islands, whereas numbers seen during other trips were low.

In 1980 and 1981, large-scale offshore surveys by Tyler *et al.* (1982) showed birds present off Northern California in "moderate numbers" in

September and October and numbers given for these years (Evens & LeValley 1981, Evens *et al.* 1982) are not comparable with numbers recorded in other years: birds may be farther offshore than regular boat trips go. Numbers remained low along the west coast of North America until a large flock appeared in Monterey Bay in 1982 (LeValley & Roberson 1983).

Ainley (1976) related the occurrence of Buller's Shearwater along coastal California to oceanographic conditions and gave three peaks of abundance — 1956, 1966-1967, and 1970-1971 — corresponding with periods of above-average upwelling and plankton volume. He stated that high numbers off California seem to foretell a period of warm water to follow. Oceanographic data are incomplete, but the peak number in Monterey Bay in September 1982 (with "moderate numbers" off Northern California in 1980 and 1981 preceding this) was followed in late 1982 by sea surface temperatures that were very much higher than average along the Pacific Coast of North America (Auer 1983).

The relationships of birds with oceanography are not well known. Further analysis, perhaps of conditions well to the north or west of the North American west coast, may offer clues as to what causes presumed non-breeding age classes of Buller's Shearwater to head either for this area or to take another route back to New Zealand.

#### ACKNOWLEDGEMENTS

I am grateful to Dr H. Ogi and Captain T. Fujii of the Faculty of Fisheries, Hokkaido University, for arranging my participation on cruises of the TV *Oshoro Maru*. On one other cruise I was funded through an OCSEAP contract to Dr J. Wiens, Oregon State University, and I was on several cruises along the North American west coast made by the RV *Thomas G. Thompson* with permission of the Department of Oceanography, University of Washington. I also thank R. Sibson and B. D. Heather for helpful comments on a previous draft of this paper.

#### LITERATURE CITED

- AINLEY, D. G. 1976. The occurrence of seabirds in the coastal region of California. *West. Birds* 7:33-68.
- AUER, S. Ed. 1983. Oceanographic monthly summary. US Dept. Comm./NOAA. Vol IV (1,2).
- BALDRIDGE, A.; CHANDIK, T.; DeSANTE, D. 1970. Fall migration. *Aud. Field Notes* 24:58.
- BRIGGS, K.; CHU, E.; LEWIS, P.; TYLER, W.; PITMAN, R.; HUNT G. Jr., 1978. Distribution, numbers, and seasonal status of seabirds of the Southern California Bight. *In* Summary of marine mammals and seabirds surveys of the Southern California Bight area, 1975-1978. Santa Cruz and Irvine, Regents of the Univ. of Calif.
- CHANDIK, T.; BALDRIDGE, A. 1968. Fall migration. *Aud. Field Notes* 22:83.
- CHANDIK, T.; DeSANTE, D.; PUGH, E. 1971. Fall migration. *Amer. Birds* 25:100.
- CROWELL, J. B., Jr; NEHLS, H. B. 1972. The fall migration. *Amer. Birds* 26:107.
- DeGANGE, A. R. 1979. *In* Data record of oceanographic observations and exploratory fishing. No. 22. Faculty of Fisheries, Hokkaido University, Hakodate, Japan.
- DeSANTE, D.; LeVALLEY, R.; STALLCUP, R. 1972. The fall migration. *Amer. Birds* 26:112.
- EVENS, J.; LeVALLEY, R. 1981. Autumn migration. *Amer. Birds* 35:219.
- EVENS, J.; ERICKSON, R.; LeVALLEY, R. 1982. Autumn migration. *Amer. Birds* 36:212.
- FAVORITE, F.; DODDMEAD, A. J.; NASU, K. 1976. Oceanography of the Subarctic Pacific region. *Int. N. Pac. Fish. Comm. Bull.* 33. 187 pp.
- GABRIELSON, I. N.; JEWETT, S. G. 1970. *Birds of the Pacific Northwest*. Dover Publ. Inc., New York. 650 pp.
- GARRETT, K.; DUNN, J. 1981. *Birds of Southern California*. Los Angeles Aud. Soc., Los Angeles. 408 pp.
- GODFREY, W. E. 1966. *Birds of Canada*. Nat. Mus. of Canada Bull. No. 203, Ottawa. 428 pp.
- GRUCHY, C. G.; DYKES, A. A. R.; BOWEN, R. H. 1972. The Short-tailed Albatross recorded at Ocean Station Papa, North Pacific Ocean, with notes on other birds. *Can. Field Nat.* 86: 285-287.
- GUIGUET, C. J. 1971. *Birds of British Columbia* (9): Diving birds and tube-nosed swimmers. BC Prov. Mus. Handbook No. 29, Victoria, B.C.
- GUZMAN, J. R.; MYRES, M. T. 1983. Occurrence of shearwaters (*Puffinus spp.*) off the west coast of Canada. *Can. Zool.* 81:2064-2077.
- HAMILTON, W. J. III. 1958. Pelagic birds observed on a North Pacific crossing. *Condor* 60:158-164.
- HUNN, E. S.; MATTOCKS, P. W., Jr. 1983. The autumn migration. *Amer. Birds* 37:214.



- JENKINS, J. A. F. 1974. Local distribution and feeding habits of Buller's Shearwater (*Puffinus bulleri*). *Notornis* 21:109-120.
- JEWETT, S. G.; TAYLOR, W. P.; SHAW, W. T.; ALDRICH, J. W. 1953. *Birds of Washington State*. Univ. of Washington Press, Seattle. 767 pp.
- KESSEL, B.; GIBSON, D. D. 1978. Status and distribution of Alaskan birds. *Studies in Avian Biol.* No. 1. 100 pp.
- KURODA, N. 1955. Observations on pelagic birds of the northwestern Pacific. *Condor* 57:290-300.
- LeVALLEY, R.; EVENS, J. 1982. Winter season. *Amer. Birds* 36:325.
- LeVALLEY, R.; ROBERSON, D. 1983. Autumn migration. *Amer. Birds* 37:219.
- LOOMIS, L. M. 1900. California water birds, No. 4 and 5. *Proc. Calif. Acad. Sci. Third Series, Zool.*, Vol. 2.
- LOOMIS, L. M. 1918. Expedition of the California Academy of Science to the Galapagos Islands, 1905-1906. A review of the albatrosses and petrels. *Proc. Cal. Acad. Sci. Fourth Ser., Zool.*, Vol. 2, No. 12.
- MARTIN, P. W.; MYRES, M. T. 1969. Observations on the distribution and migration of some seabirds off the outer coasts of British Columbia and Washington State, 1946-1949. *Syesis* 2:241-256.
- MATTOCKS, P. W. J.; HUNN, E. S. 1983. The winter season. *Amer. Birds* 37:330.
- McCASKIE, G. 1966. The nesting season. *Aud. Field Notes* 20:599.
- McCASKIE, G. 1969. Fall migration. *Aud. Field Notes* 23:106.
- McCASKIE, G. 1970. The fall migration. *Aud. Field Notes* 24:97.
- McCASKIE, G. 1976. The winter season. *Amer. Birds* 30:764.
- McCASKIE, G. 1977. The fall migration. *Amer. Birds* 31:221.
- McCASKIE, G. 1978. The nesting season. *Amer. Birds* 30:1003.
- McCASKIE, G. 1980. The autumn migration. *Amer. Birds* 34:199.
- McCASKIE, G. 1981. The autumn migration. *Amer. Birds* 35:225.
- NAKAMURA, K.; HASEGAWA, M. 1979. A brief note on distribution of Buller's Shearwater, *Puffinus bulleri*, in Japan and adjacent seas. *J. Yamashina Inst. Ornith.* Vol. 11 (2):123-127.
- PAXTON, R.; CHANDIK, T. 1967. Fall migration. *Aud. Field Notes* 21:72.
- REMSEN, V.; GAINES, D. A. 1973. The nesting season. *Amer. Birds* 27:912.
- SANGER, G. A. 1965. Observations of wildlife off the coast of Washington and Oregon in 1963, with notes on the Laysan Albatross (*Diomedea immutabilis*) in the area. *Murrelet* 46:1-6.
- SANGER, G. A. 1972. Checklist of bird observations from the eastern North Pacific Ocean, 1955-1967. *Murrelet* 53:16-21.
- SHUNTOV, V. P. 1974. Seabirds and the biological structure of the ocean. (Trans. from Russian). TT74-55032, NTIS, U.S. Dept. Comm. 1974.
- SLEPTSOV, M. M. 1960. Buller's Shearwater in U.S.S.R. waters. *Ornitologia* 3:410-412. (Transl. from the Russian by W. Hall).
- STALLCUP, R.; WINTER, J. 1976. The winter season. *Amer. Birds* 30:761.
- TYLER, W. B., LEWIS, D. B.; BRIGGS, K. T., DETTMAN, K. F. 1982. Seabird findings. In Dohl, T. P., et al. Marine mammal and seabird study Central and Northern California. USDI POCS Tech. Paper No. 82-1.
- WAHL, T. R. 1975. Seabirds in Washington's offshore zone. *West. Birds* 6:117-134.
- WOHL, K. D. 1975. Sightings of New Zealand Shearwaters in the northern Gulf of Alaska. *Can. Field Nat.* 89:320-321.
- WAHL., T. R. Dept. of Biology, Western Washington University, Bellingham, Washington 98225, USA. Present address: 3041 Eldridge, Bellingham, Washington 98225, USA.**