SEABIRD POPULATION DATA AND HUMAN DISTURBANCE OF BREEDING COLONIES IN SOUTH-CENTRAL CALIFORNIA, 1979-1995

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Final Report
August 1998

Prepared for: California Department of Fish and Game (Office of Oil Spill Prevention and Response, Sacramento, California).

Suggested Citation: Carter, H.R., P.J. Capitolo, W.R. McIver, and G.J. McChesney. 1998. Seabird population data and human disturbance of seabird colonies in South-Central California, 1979-1995. Unpubl. final report, U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, Dixon, California; and Humboldt State University, Department of Wildlife, Arcata, California. 35 pp.

INTRODUCTION

Reduction of human disturbance at seabird breeding colonies and roosts in South-Central California is being considered by state and federal trustee agencies as a possible restoration project for the 1997 *Torch/Platform Irene* oil spill. Colonially-nesting seabirds are very susceptible to various forms of human disturbance which can impact breeding success and population size (see summaries in: Manuwal 1978; Anderson and Keith 1980). In South-Central California, human disturbance could be reduced by developing, implementing, enforcing, and educating the public about new protective measures for seabird colonies and roosts which would address disturbance from aerial overflights, landing on islands and rocks, close approach by boats and other watercraft, and close approach on foot or by vehicle on land. Seabird population responses to such measures would include increased breeding success, population size, and roosting use. These benefits to seabird populations would help compensate for injuries to seabirds from the oil spill by speeding and ensuring natural population recovery in the near future. Benefits of such measures also would extend to other seabirds, marine mammals, and other sensitive coastal resources in the region, as well as benefit local communities supported by coastal recreation and tourism.

As part of considering the value of this possible restoration project to seabird populations and developing more specific plans and budgets for this work, we have identified and collated available data for seabird colonies in South-Central California from 1979-1995 for three seabird species: Brandt's Cormorant (*Phalacrocorax penicillatus*), Common Murre (*Uria aalge*), and Brown Pelican (*Pelecanus occidentalis*). The first two species were heavily impacted by the spill (P.R. Kelly, pers. comm.) whereas the pelican is an endangered species which would also benefit from increased protection of roosts (Gress and Anderson 1983). For this report, we confined this summary to the distinct geographic region of "South-Central California", here defined as the coastal region between Point Pinos and Point Conception in Monterey, San Luis Obispo and Santa Barbara counties. The 1997 *Torch/Platform Irene* oil spill occurred in the southern part of this region.

To assist interpretation of cormorant colony data, we also have provided a preliminary assessment of human disturbance to Brandt's Cormorant colonies in South-Central California. Brandt's Cormorants nest in colonies on the surface of coastal rocks and on mainland cliffs and are very susceptible to disturbance by human activities at or near colonies (Ellison and Cleary 1978; McChesney 1997). In response to disturbances, nesting cormorants typically "flush" (i.e. rapidly take to flight and leave the colony), leaving nests unattended for a period of time. This process can result in loss of eggs and chicks through damage or predation. If frequent and/or impacts great enough, such disturbances can result in colony reduction or abandonment in a particular year and possible long-term colony extirpation in future years. By inspecting available colony data, we identified major changes in numbers of nesting birds which may result from significant human disturbances. Since Brandt's Cormorants in this region were not heavily affected by other anthropogenic impacts during this time period, we consider such changes to represent such disturbances, in concert with possible natural changes. To identify possible human disturbance of various seabird colonies throughout South-Central California, we also

have focused on assessing changes in cormorant numbers because cormorant breeding colonies are distributed throughout the region (Carter et al. 1992, 1996).

COLLATION OF SEABIRD POPULATION DATA

We collated population data for Brandt's Cormorants, Common Murres and Brown Pelicans at breeding colonies on coastal rocks and mainland cliffs in South-central California from 1979-1995 from 6 major sources: 1) state-wide surveys of breeding colonies for all seabirds in 1979-1980 by the U.S. Fish and Wildlife Service (Sowls et al. 1980); 2) aerial surveys of seabird populations at sea in 1980-1982 by the University of California Santa Cruz (Briggs et al. 1983, 1987); 3) surveys of Common Murre colonies in 1986-1988 and 1990 by the U.S. Fish and Wildlife Service (Takekawa et al. 1990; Carter and Takekawa, unpubl. data); 4) state-wide survey of breeding colonies for all seabirds in 1989 by the U.S. Fish and Wildlife Service and Humboldt State University (Carter et al. 1992); 5) an annual state-wide seabird monitoring program for Common Murres, Brandt's Cormorants and Double-crested Cormorants (*Phalacrocorax auritus*) from 1993-1995 by the U.S. Geological Survey (previously National Biological Service), U.S. Fish and Wildlife Service, and Humboldt State University (Carter et al. 1996; Carter and Takekawa, unpubl. data); and 6) a recent summary of Common Murre and Brandt's Cormorant data at Castle Rocks & Mainland and Hurricane Point Rocks for the 1979-1997 period is in preparation by the U.S. Geological Survey and U.S. Fish and Wildlife Service (McChesney et al., in prep.; Manuwal et al., in prep.). These six sources of available data comprise the vast majority of seabird population data collected at these locations during the breeding season from 1979-1995. However, other data exist for surveys during the non-breeding season, especially important for roosting Brown Pelicans and cormorants (e.g. Briggs et al. 1983; Jaques 1994), which have not been collated in this report.

A list of known breeding colonies of Brandt's Cormorants and Common Murres is presented in Table 1. In addition, we have cross-referenced colony names, USFWS Colony numbers, California Colony Numbers, and Colony Map Numbers. With this information, one can better locate maps presented in Carter et al. (1992) for exact geographic locations of colonies. In addition, colony maps from Carter et al. (1992) can be accessed on the internet through the web site for the California State Lands Commission (http://www.slc.ca.gov). At present, population data are not yet available on the internet.

In collating and summarizing Brandt's Cormorant and Common Murre data (Tables 2-5), we aimed to provide comparable raw data from available sources during the 1979-1995 period, augmented with some earlier observations in 1970-1972 (Osborne and Reynolds 1971; Sowls et al. 1980). However, owing to insufficient description of data collection methods, we are not certain how comparable 1970-1972 data are to data collected between 1979-1995. To identify major changes in numbers of nesting birds, we have summarized population data only from complete surveys conducted during the main breeding season from mid May to mid July. We presented data for each species and two periods (1979-1987 and 1988-1995) in separate tables, as follows: Table 2 (Brandt's Cormorant 1979-1987); Table 3 (Brandt's Cormorant 1988-1995);

Table 4 (Common Murre 1979-1987); and Table 5 (Common Murre 1988-1995). In each table, data for each colony is presented in the same north to south order. For Brandt's Cormorant nest counts, we included all nests counted on a specific survey in each year. For counts of Brandt's Cormorants attending nests, we included birds associated with nesting areas and excluded roosting birds in other nearby non-nesting areas. We included all Common Murres counted at colonies (including breeding adults and non-breeding birds) in the counts presented. Murres do not build nests and lay eggs directly onto the nest-site substrate (e.g. guano or bare rock), often incubating eggs with their feet. Thus, "nests" cannot be counted.

In collating and summarizing Brown Pelican data (Table 6 [1979-1987] and Table 7 [1988-1995]), we aimed to provide general information about the presence and numbers of roosting pelicans at these locations at this time of year (mid May to mid July). Pelican roosts also occur at other locations which were not surveyed on a regular basis with cormorant and murre colonies. Peak counts of roosting pelicans along the coast tend to occur later in the year (i.e. usually September; Briggs et al. 1983; Jaques 1994). In addition, pelican counts were not the primary focus during surveys and some roosting birds may have been omitted in certain counts. Thus, the counts presented should be considered as "minimums" but useful for identifying general levels of use of coastal rocks during the summer period. Variation in numbers of roosting pelicans also may reflect variation in local roosting behavior, changes in numbers of pelicans using different coastal areas, or human disturbance (Jaques 1994; Jaques et al. 1996).

PRELIMINARY ASSESSMENT OF HUMAN DISTURBANCE OF CORMORANT COLONIES

To assist the interpretation of cormorant colony data, we have conducted a preliminary assessment of human disturbance to cormorant colonies (Table 8). Given incomplete data for some years, single surveys per year, and known aspects of cormorant nesting biology and behavior, we judged and assigned each colony to general categories based on general colony trends, type of possible disturbance evidence available, and potential for disturbance related to the geographic location of the colony. Three main aspects of cormorant behavior that we accounted for in our treatment were: 1) breeding phenology may vary to a limited degree between years and be protracted such that some nests may have been abandoned before surveys or built after surveys in some years; 2) low attendance by cormorants in 1993 was considered to reflect a response to a severe on-going El Niño event (a similar response was suspected for 1983 but no surveys were conducted in the 1983-1985 period); and 3) movements of nesting birds to adjacent colonies were considered to have possibly resulted from human disturbance and/or natural variation in use of local nesting areas within colony complexes (see Ainley and Boekelheide 1990; Carter et al. 1992; McChesney 1997).

For assessing human disturbance to cormorant colonies over the 1979-1995 period, five important insights into the breeding cormorant population in South-Central California can be immediately gleaned from this data summary:

1) From 1970-1995, three colonies that have been "protected" from human disturbance for several decades have hosted most nesting Brandt's Cormorants in South-Central California: a) at Bird Rock, disturbance is reduced by the presence of a public viewing area and a golf course adjacent to the colony; b) Bird Island is protected within the Point Lobos State Reserve and also has a public viewing area and local housing community nearby; and c) Piedras Blancas Island is located beside a large lighthouse with restricted entry and constant observation of federal government personnel;

2) The overall Brandt's Cormorant breeding population in South-Central California roughly doubled from 1970-1972 (about 4,238 nests) to 1979 (7,087 nests), then rose further by 1989 (8,900 nests), and then has declined by about 15% from 1989 to 1994-1995 (about 7,600 nests);

3) Eight colonies identified in 1970-1972 (Osborne and Reynolds 1971) were not used for nesting in the 1979-1987 period, including: Torre Canyon Rocks, Anderson Canyon Rocks, Dolan Rock, Square Black Rock, Lopez Rock, Plaskett Rock, Unnamed Rock, and La Cruz Rock;

4) Thirteen colonies became active in the 1988-1995 period that were not active in 1979-1987, including: a) 5 of the 8 colonies that were inactive in 1979-1987 (i.e. Anderson Canyon Rocks, Lopez Rock, Plaskett Rock, Unnamed Rock, and La Cruz Rock); and b) 8 other colonies without recorded previous nesting use (i.e. Guillemot Island Area, Partington Ridge South, Seastack South of Redwood Gulch, 3 Rocks, Morro Rock & Pillar Rock, Pup Rock & Adjacent Mainland, Point Arguello, and Rocky Point); and

5) Four of the 8 newly-recorded colonies in 1988-1995 occur in "protected" areas: a) Guillemot Island Area occurs in Point Lobos State Reserve; b) Morro Rock & Pillar Rock occur within the Morro Rock State Reserve; and c) Point Arguello and Rocky Point occur within Vandenberg Air Force Base. At Morro Rock and Pillar Rock, Double-crested Cormorants also were first recorded nesting in 1989 (24 nests) and have increased by 1994 (137 nests) (Carter et al. 1992, 1995; Carter and Takekawa, unpubl. data). This colony and nearby Fairbank Point (a "protected" area in Morro Bay) constitute the "core" of a newly-established population of this species in South-Central California. However, this species is expanding in several areas and small numbers of Double-crested Cormorants also were noted at other colonies in this region in 1989 (i.e. Partington Ridge North, Anderson Canyon Rocks, Rockland landing North, and Cape San Martin).

Seven areas of high concern for possible human disturbance in South-Central California at the present time were identified:

A) *Castle Rocks & Mainland and Hurricane Point Rocks*: Direct observations of human disturbance to cormorants and murres have been made at this colony complex due to low overflights and close approach by boats (Parker et al. 1998; M.W. Parker, unpubl. data; B. Walton, pers. comm.). In addition, cormorant data indicate potential impacts from such disturbances over time. These rocks occur close to shore, just north of Hurricane Point and near the scenic Bixby Bridge where low overflights have been noted for many years. In addition, this area contained the only Common Murre colonies in South-Central California known between 1979 and 1995. This murre colony has been reduced to low numbers by mortality from gill-net fishing and the *Apex Houston* oil spill. Human disturbance may contribute to low breeding success. Another murre colony was found in 1996 just north of Castle Rocks & Mainland at Bench Mark-227x (Parker et al. 1997; McChesney et al. in prep.);

B) *Pfeiffer Point*: This small colony may have been abandoned due to disturbance from coastal recreationists within state parks. This colony has not been noted since 1979. It may be missed during aerial surveys due to its small size but was not noted on a boat survey in 1989. No boat surveys (which better detect small colonies) have been conducted since 1989 to confirm colony status;

C) *Lafler Rock to Burns Creek Rocks Region (includes 7 adjacent colonies)*: In this colony complex, there has been loss of nesting at one colony, decline at one colony, a lack of re-colonization at one colony (active nesting in 1970), and much "re-arrangement" of nesting birds (through intra-colony complex movements). Overall numbers have declined since 1979 (645 in 1979; 533 in 1989; 261-369 in 1994-1995). Disturbance from low overflights may have caused low breeding success and reduced overall numbers of nesting birds in this complex. Cormorants nest mainly on rocks near shore where coastline-flying aircraft may fly directly overhead;

D) *Dolan/Square Black Rocks*: These rocks did not have nesting cormorants in 1979-1995 but nesting was observed at both rocks in 1970 and suitable nesting habitat apparently still exists. Disturbance from low overflights may prevent re-colonization of these rocks. Both rocks occur near shore where coastline-flying aircraft may fly directly overhead;

E) *Plaskett Rock*: This colony was present in 1970 but not in 1979, was re-colonized by 1989 (386 nests), but had low numbers in 1994-1995 (about 50-60 nests). Disturbance from low overflights may cause low breeding success and future abandonment of this site. The rock occurs near shore where coastline-flying aircraft may fly directly overhead;

F) *3 Rocks/La Cruz Rock*: No nesting was noted in 1970 and 1979. These colonies became active in 1989 (300 nests) but had low numbers in 1994-1995 (about 50-100 nests). Disturbance from low overflights and mainland activities may have caused low breeding success and may lead to future abandonment of these sites. Both rocks occur near shore where coastline-flying aircraft may fly directly overhead and coastal recreationists may disturb nesting birds (e.g. near Ragged Point Lodge); and

G) *Diablo Canyon Nuclear Power Plant Area (includes 5 adjacent colonies)*: This colony complex has grown from about 200 nests in 1979-1980, 728 in 1989, and up to a high of 1,259 nests in 1995. This increase may be related partly to protection provided by mainland security around the nuclear power plant. At the same time, there has been loss of nesting at 2-3 colonies and much "re-arrangement" of nesting birds, apparently through intra-colony complex movements. Thus, disturbance may be occurring at certain colonies in the complex and not others. Such disturbance (possibly from mainland activities and low overflights) could lead to low breeding success and an overall reduction in future numbers. Cormorants nest mainly on rocks near shore where coastline-flying aircraft may fly directly overhead. This area is not included in the Monterey Bay National Marine Sanctuary and has few if any overflight restrictions. Human activities related to the operations of the plant and coastal recreationists may disturb nesting birds. In particular, nesting at Diablo Rock & Adjacent Mainland may be reduced by hot water discharge from the plant or other human activities near the main plant. In addition, boats from nearby Morro Bay and Avila Beach may disturb nesting birds.

CONCLUSIONS

Based on available population data from 1979-1995, human disturbance appears to have greatly affected the breeding population of Brandt's Cormorants in South-Central California over the past three decades by: 1) greatly affecting the distribution of nesting colonies and helping to create three "core" colonies in protected areas; 2) causing a fluctuating overall population size that has not achieved near carrying capacity levels based on available nesting habitat and prey resources; 3) causing erratic use of specific colony locations and related fluctuations at adjacent colonies; and 4) causing low breeding success at many breeding colonies over time. Protection of certain colonies since the 1970s apparently has led to a larger current breeding population over a wider coastal area than existed in the early 1970s. However, human disturbances appear to continue to impact colonies in many coastal areas.

The seven areas identified above appear to suffer most at the present time from human disturbance and should be investigated further to develop specific restoration plans. To further refine plans, it would be valuable to: 1) examine data from additional aerial photographs of breeding colonies taken in 1996-1998 but not yet counted (M.W. Parker, unpubl. data) to help confirm patterns that we have noted with available data from 1979-1995; and 2) obtain additional information on the types and degree of human disturbance at these and other colony

locations. Potential solutions to individual colony disturbances also might be best considered within a larger plan that considers all colonies and roosts, as well as various human activities in the present and future which may affect breeding by cormorants, murres, and other seabirds (and roosting by pelicans and other seabirds) throughout South-Central California. For example, levels and types of coastal recreation are increasing and long-term planning is necessary to prevent future impacts to seabird populations.

ACKNOWLEDGEMENTS

Funding for this summary was provided by the California Department of Fish and Game (Office of Oil Spill Prevention and Response) with assistance from Paul Kelly. Denise Steurer (U.S. Fish and Wildlife Service) and Nancy Read (Vandenberg Air Force Base) also supported the need for this work. This project was conducted as part of a cooperative research effort between the U.S. Geological Survey (Biological Resources Division) and Humboldt State University (Principal Investigators: Richard T. Golightly and Harry R. Carter). Office and other administrative support have been provided by Dennis Orthmeyer and James Hamby.

LITERATURE CITED

Ainley, D.G., and R.J. Boekelheide (Eds.). 1990. Seabirds of the Farallon Islands: ecology, structure and dynamics of an upwelling-system community. Stanford Univ. Press, Stanford, California.

Anderson, D.W., and J.O. Keith. 1980. The human influence on seabird nesting success: conservation implications. Biological Conservation 18: 65-80.

Briggs, K.T., W.B. Tyler, D.B. Lewis, and K.F. Dettman. 1983. Seabirds of central and northern California, 1980-1983: status, abundance, and distribution. Unpubl. report, Center for Marine Studies, University of California, Santa Cruz, California.

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Briggs, K.T., W.B. Tyler, D.B. Lewis, and D.R. Carlson. 1987. Bird communities at sea off California: 1975-1983. Stud. Avian Biol. 11.

Carter, H.R., G.J. McChesney, D.L. Jaques, C.S. Strong, M.W. Parker, J.E. Takekawa, D.L. Jory, and D.L. Whitworth. 1992. Breeding populations of seabirds in California, 1989-1991. Vols. 1 and 2. Unpubl. draft final report, U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Dixon, California.

Carter, H.R., A.L. Sowls, M.S. Rodway, U.W. Wilson, R.W. Lowe, F. Gress and D.W. Anderson. 1995. Population size, trends, and conservation problems of the Double-crested Cormorant on the Pacific coast of North America. Pp. 189-215. *In* D.N. Nettleship and D.C. Duffy (Eds.). The Double-crested Cormorant: biology, conservation and management. Colonial Waterbirds 18 (Special Publication 1).

Carter, H.R., G.J. McChesney, J.E. Takekawa, L.K. Ochikubo, D.L. Whitworth, T.W. Keeney, W.R. McIver, and C.S. Strong. 1996. Population monitoring of seabirds in California: 1993-1995 aerial photographic surveys of breeding colonies of Common Murres, Brandt's Cormorants and Double-crested Cormorants. Unpubl. final report, U.S. Geological Survey, Biological Resources Division, California Science Center, Dixon, California.

Ellison, L.N., and L. Cleary. 1978. Effects of human disturbance on breeding of Double-crested Cormorants. Auk 95: 510-517.

Gress, F., and D.W. Anderson. 1983. A recovery plan for the California Brown Pelican. U.S. Fish and Wildlife Service, Portland, Oregon.

Jaques, D.L. 1994. Range expansion and roosting ecology of non-breeding California Brown Pelicans. Unpubl. M.Sc. thesis, University of California, Davis, California.

Jaques, D.L., C.S. Strong, and T.W. Keeney. 1996. Brown Pelican roosting patterns and responses to disturbance at Mugu Lagoon and other non-breeding sites in the Southern California Bight. National Biological Service, Technical Report No. 54, Tucson, Arizona.

Manuwal, D.A. 1978. Effect of man on marine birds: a review. Pp. 140-160. *In* Wildlife and People. John S. Wright Forestry Conference Proceedings, Department of Forestry and natural Resources and the Cooperative Extension Service, Purdue University.

Manuwal, D.A., H.R. Carter, R.W. Lowe, R.W. Lowe, U.W. Wilson, J.E. Takekawa, M.S. Rodway, and T. Zimmerman. In prep. Assessment of the biology, population status and conservation of the Common Murre (*Uria aalge californica*) in California, Oregon, Washington, and British Columbia. Chapters 1 and 2: Natural History and Population Trends. Unpubl. draft report, U.S. Fish and Wildlife Service, Portland, Oregon.

McChesney, G.J. 1997. Breeding biology of the Brandt's Cormorant on San Nicolas Island, California. Unpubl. M.A. thesis, California State University, Sacramento, California.

McChesney, G.J, H.R. Carter, M.W. Parker, P.J. Capitolo, and J.E. Takekawa. In prep. Subcolony use by Common Murres at Castle rocks & Mainland and Hurricane Point Rocks, California, 1979-1997. Unpubl. draft report, U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, Dixon, California; Humboldt State University, Department of Wildlife, Arcata, California 95521; and U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge, Newark, California.

Osborne, T.O., and J.G. Reynolds. 1971. California seabird breeding ground survey 1969-1970. Unpubl. report, California Department of Fish and Game, Wildlife Management Branch, Administrative Report No. 71-3, Sacramento, California.

Parker, M.W., E.B. McLaren, S.E. Schubel, J.A. Boyce, P.J. Capitolo, M.A. Ortwerth, S.W. Kress, H.R. Carter, and A.M. Hutzel. 1997. Restoration of Common Murre colonies in central California: annual report 1996. Unpubl. report, U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge, Newark, California.

Parker, M.W., E.B. McLaren, J.A. Boyce, V. Collins, D.A. Nothelfer, R.J. Young, S.W. Kress, H.R. Carter, and A.M. Hutzel. 1998. Restoration of Common Murre colonies in central California: annual report 1997. Unpubl. report, U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge, Newark, California.

Sowls, A.L., A.R. DeGange, J.W. Nelson, and G.S. Lester. 1980. Catalog of California seabird colonies. U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS 37/80.

Takekawa, J.E., H.R. Carter, and T.E. Harvey. 1990. Decline of the Common Murre in central California, 1980-1986. Pp. 149-163. *In* S.G. Sealy (Ed.). Auks at sea. Stud. Avian Biology No. 14.

Table 1. Summary of seabird colony names in South-Central California and associated USFWS Colony Numbers, California Colony Numbers, and Colony Map Numbers (from Carter et al. 1992; also see Sowls et al. 1980).

Colony Name	California Colony Number	USFWS Colony Number	Colony Map Numbers[1]
MONTEREY COUNTY			
Bird Rock	MO-362-03	454-006	129
Guillemot Island Area	MO-362-06	454-023	130
Pinnacle Point Area	MO-362-07	454-007	130
Bird Island	MO-362-09	454-009	130
Bench Mark-227x	MO-362-18	454-029	133
Castle Rocks & Mainland	MO-362-19	454-010	133
Hurricane Point Rocks	MO-362-20	454-011	133
Cooper Point & Islands	MO-360-03	454-031	135
Pfeiffer Point	MO-360-04	454-032	135
Grimes Point	MO-360-06	454-033	136
Lafler Rock & Mainland	MO-360-07	454-034	136
Torre Canyon Rocks	MO-360-08	454-013	136
Partington Ridge North	MO-360-10	454-014	137
McWay Rocks	MO-360-11	454-015	137
Partington Ridge South	MO-360-12	454-035	137
Anderson Canyon Rocks	MO-360-13	454-016	137
Burns Creek Rocks	MO-360-14	454-017	137
Dolan Rock	MO-360-16	454-018	138
Square Black Rock	MO-360-18	454-019	138
Lopez Rock	MO-360-21	454-020	139
Rockland Landing North	MO-360-23	454-037	140
Plaskett Rock	MO-354-07	477-002	142
Cape San Martin	MO-354-08	477-003	143
Unnamed Rock	MO-354-09	477-004	143
Redwood Gulch Rock	MO-354-12	477-005	144
Seastack South (S) of Redwood Gulch	MO-354-13	477-018	144
Unmapped Island	MO-354-14	477-019	144
SAN LUIS OBISPO COUNTY			
3 Rocks	SL-354-03	477-023	145
La Cruz Rock	SL-354-04	477-006	146
Piedras Blancas Island	SL-352-01	477-007	147
Morro Rock & Pillar Rock	SL-352-07	477-026	150
Point Buchon	SL-350-02	477-009	151

Table 1 (Continued)

Colony Name	California Colony Number	USFWS Colony Number	Colony Map Numbers
Pup Rock & Adjacent Mainland	SL-350-04	477-028	152
Lion Rock	SL-350-05	477-011	152
Diablo Rock & Adjacent Mainland	SL-350-06	477-029	152
Diablo Canyon Nuclear Power Plant (N.P.P.) South	SL-350-07	477-030	152
Pecho Rock	SL-350-09	477-032	153
SANTA BARBARA COUNTY			
Point Arguello	SB-342-04	501-011	165
Rocky Point	SB-342-05	501-012	165

[1] Maps are presented in Carter et al. (1992).

Table 2. Summary of total numbers of Brandt's Cormorants counted from aerial photographs and other surveys at breeding colonies in South-Central California, 1979-1987. Unbracketed numbers refer to aerial photographs taken during the central part of the breeding season (mid May to mid July). Scroll brackets refer to total counts (nest/birds) using other survey methods, including aerial, ground and/or boat count methods. Scroll brackets without a footnote denoting survey method refer to combined aerial and other survey methods. Data sources for each year are indicated with alphabetized footnotes. Codes used: ND, no data obtained; -, no counts available; underlined numbers, incomplete counts but most nests/birds accounted for. Aerial surveys were not conducted in 1983-1985.

	Year					
Colony Name	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
MONTEREY COUNTY						
Bird Rock[5]	1,000/-[a]	670/-[a] - /1,755[(July)c]	- /950[(May)c] - /2,500[(July)c]	- /1,238[(June)c]	ND	857/1,430[f]
Guillemot Island Area	{0/-}[a,1]	ND	ND	ND	ND	ND
Pinnacle Point Area	{100/-}[a,1]	ND	ND	ND	ND	ND
Bird Island	3,000/-[a]	2,100/-[a] - /3,038[(July)c]	- /2,582[(May)c] - /3,137[(July)c]	- /1,455[(July)c]	ND	1,801/3,301[f]
Bench Mark-227x[g,10]	{0}[1]	ND	ND	ND	ND	ND
Castle Rocks & Mainland[g]	{267/-}[a,1]	{13/-}[a,c]	253/-[g]	47/-[g]	3/-[g]	128/-[g]
Hurricane Point Rocks[g]	{271/-}[a,1]	{273/-}[a,c]	0/-[g]	0/-[g]	67/-[g]	69/-[g]

Table 2 (Continued)

Colony Name	Year					
	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
Cooper Point & Islands[5]	{36/-}[a,1]	ND	ND	ND	ND	ND
Pfeiffer Point	{3/-}[a,1]	ND	ND	ND	ND	ND
Grimes Point	{8/-}[a,1]	ND	ND	ND	ND	ND
Lafler Rock & Mainland	{6/-}[a,1]	ND	ND	ND	ND	ND
Torre Canyon Rocks[5]	{0/-}[a,1]	ND	ND	ND	ND	ND
Partington Ridge North[5]	{455/-}[a,1]	ND	ND	ND	ND	ND
McWay Rocks[5]	{10/-}[a,1]	ND	ND	ND	ND	ND
Partington Ridge South	{0/-}[b,1]	ND	ND	ND	ND	ND
Anderson Canyon Rocks[5]	{0/-}[a,1]	ND	ND	ND	ND	ND
Burns Creek Rocks[5]	{174/-}[a,1]	ND	ND	ND	ND	ND

Table 2 (Continued)

Colony Name	Year 1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
Dolan Rock[5]	{0/-}[a,1]	ND	ND	ND	ND	ND
Square Black Rock[5]	{0/-}[a,1]	0/-[a]	ND	ND	ND	ND
Lopez Rock[5]	{0/-}[a,1]	0/-[a] - /<50[(July)c]	- /<50[(May)c] - /402[(July)c]	- /92[(June)c]	ND	ND
Rockland Landing North[5]	{8/-}[a,1]	ND	ND	ND	ND	ND
Plaskett Rock[5]	{0/-}[a,1]	0/-[a]	ND	ND	ND	ND
Cape San Martin	{614/-}[a,1]	340[a]/- - /939[(July)c]	- /605[(May)c] - /1,219[(July)c]	- /127[(June)c]	ND	ND
Unnamed Rock	{0/-}[a,1,2]	ND	ND	ND	ND	ND
Redwood Gulch Rock[5]	{239/-}[a,1,2]	ND	ND	ND	ND	ND
Seastack S of Redwood Gulch	{0/-}[a,1]	ND	ND	ND	ND	ND
Unmapped Island	{28/-}[b,1]	ND	ND	ND	ND	ND

Table 2 (Continued)

Colony Name	Year 1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
SAN LUIS OBISPO COUNTY						
3 Rocks	{0/-}[a,1]	ND	ND	ND	ND	ND
La Cruz Rock[5]	{0/-}[a,1]	{0/-}[a,1]	ND	ND	ND	ND
Piedras Blancas Island[5]	680/-[a]	600/-[a] - /1,011[(July)c]	- /1,956[(May)c] - /1,281[(July)c]	- /378[(June)c]	ND	ND
Morro Rock & Pillar Rock	{0/28}[b,1]	ND	ND	ND	ND	ND
Point Buchon	{0/-}[a,1]	{7/-}[b,1]	ND	ND	ND	ND
Pup Rock & Adjacent Mainland	{0/-}[a,1]	{0/-}[a,1]	ND	ND	ND	ND
Lion Rock[5,7]	{0/-}[a,1]	0/-[a] - /350[(July)c]	- /<50[(May)c] - /<99[(July)c]	- /<50[(June)c]	ND	ND
Diablo Rock & Adjacent Mainland	{180/-}[a,1]	{106/-}[a,1]	ND	ND	ND	ND
Diablo Canyon N. P. P. South	{8/-}[a,1]	{50/-}[a,1]	ND	ND	ND	ND
Pecho Rock[5]	70/-[a]	74/-[a] - /394[(July)c]	- /<50[(May)c] - /212[(July)c]	- /158[(June)c]	ND	ND

Table 2 (Continued)

	Year					
Colony Name	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
SANTA BARBARA COUNTY						
Point Arguello	{0/-}[a,1]	{0/-}[a,1]	ND	ND	ND	ND
Rocky Point	{0/-}[a,1]	ND	ND	ND	ND	ND
TOTAL	7,087/ND	ND	ND	ND	ND	ND

Footnotes:

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep).

Numerical Footnotes

[1] boat census.

[2] mainland census.

[3] 0 birds when no photographs taken but indicated in notes.

[4] 0 birds assumed (no photographs or notes).

[5] Sowls et al. (1980) reported the following surveys during mid May to mid July 1970 (from Osborne and Reynolds 1971): Bird Rock, 15 July 1970, 300 nests, aerial; Cooper Point & Islands, 15 July 1970, 0 nests, aerial; Partington Ridge North, 14 May 1970, 63 nests, mainland; McWay Rocks, 22 July 1970, 40 nests, mainland; Anderson Canyon Rocks, 22 July 1970, 142 nests, mainland; Burns Creek Rocks, 22 July 1970, 15 July 1970, 30 nests, mainland; Torre Canyon Rocks, 14 June 1970, 63 nests, mainland; Dolan Rock, 15 July 1970, 50 nests, aerial; Square Black Rock, 15 July 1970, 10-20 nests, aerial; Lopez Rock, 23 July 1970, 50 nests, mainland; Rockland Landing North, 23 July 1970, 10-20 nests, mainland; Redwood Gulch Rock, 21 July 1970, 300 nests, mainland; La Cruz Rock, 19 July 1970, 0 nests, mainland; Piedras Blancas Island, 15-19 July 1970, 100 nests, aerial and mainland; Lion Rock, 15 July 1970, 350 nests, mainland; Pecho Rock, 15 July 1970, 0 nests, aerial. In addition, Sowls et al. (1980) reported other surveys between 1969-1972 for: Pinnacle Point Area, Bird Island, Plaskett Rock, Cape San Martin, and Unnamed Rock. By adding numbers from mid May to mid July 1970 (1,508 nests) to highest counts from other surveys at the latter 5 colonies in 1970-1972 (2,730 nests), we determined a total of 4,238 nests for the 1970-1972 period.

[6] Birds described as unidentified cormorants.

[7] Sowls et al. (1980) reported the following surveys at Lion Rock: 1972, 100 nests, landed (Frame); 1978, 50 nests, landed (Chambers).

[8] Combined aerial/boat survey. Incorrect totals of 2,796 nests and 3,174 birds were reported in Carter et al. (1992).

[9] Boat survey. Incorrect totals of 53 nests and 59 birds were reported in Carter et al. (1992).

[10] Brandt's Cormorants nests/birds and Common Murres were observed at this colony in 1996 and 1997 (Parker et al. 1998).

Table 3. Summary of total numbers of Brandt's Cormorants counted from aerial photographs and other surveys at breeding colonies in South-Central California, 1988-1995. Table format and symbols as in Table 2. Aerial surveys were not conducted in 1991-1992.

	Year					
Colony Name	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
MONTEREY COUNTY						
Bird Rock[5]	793/1,275	1,205/1,492 {- /880}[1] {470/790}[2]	1,202/2,114	570/810[f]	1,060/1,710[f]	981/1,438[f]
Guillemot Island Area	145/264	252/333	0/5	0/0[f]	17/71[f]	237/272[f]
Pinnacle Point Area	133/294	{0/0}[1]	191/349	0/0[f]	328/1,252[f]	442/1,148[f]
Bird Island	1,884/3,609	{2,921/3,309}[8]	2,609/3,792	789/2,131[f]	2,942/4,439[f]	2,261/3,410[f]
Bench Mark-227x[10]	ND	{0}	ND	ND	ND	ND
Castle Rocks & Mainland[g]	72/-[g]	{341/750}[g]	184/-[g]	84/136[e]	249/326[e]	141/153[g]
Hurricane Point Rocks[g]	46/-[g]	13/29[g]	0/-[g]	0/0[e]	0/9[g]	30/35[g]
Cooper Point & Islands[5]	ND	{17/21}[1]	ND	ND	ND	ND
Pfeiffer Point	ND	{0/0}[1]	ND	ND	ND	ND

Table 3 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Grimes Point	ND	89/106 {70/85}[1]	ND	0/0[f,3]	146/234[f]	153/184[f]
Lafler Rock & Mainland	ND	{107/136} {61/ND}[1] {61/86}[2]	ND	0/-[f,4]	19/32[f]	1/9[f]
Torre Canyon Rocks	ND	{0/0}[1]	ND	ND	ND	ND
Partington Ridge North[5]	ND	{78/113} {38/19}[1]	ND	0/-[f,4]	4/13[f]	135/167[f]
McWay Rocks[5]	ND	48/56 {22/ND}[1] {23/27}[2]	ND	0/0[f,3]	0/0[f]	0/0[f]
Partington Ridge South	ND	{7/7}[1]	ND	0/-[f,4]	0/0[f]	4/4[f]
Anderson Canyon Rocks[5]	ND	{146/165} {46/2}[1]	ND	0/-[f,4]	221/379[f]	38/42[f]
Burns Creek Rocks[5]	ND	{147/163} {75/12}[2]	ND	0/-[f,4]	17/50[f]	191/210[f]

Table 3 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Dolan Rock	ND	{0/0}[1]	ND	0/-[f,4]	0/-[f,4]	0/-[f,4]
Square Black Rock	ND	0/0 {0/0}[1]	ND	0/0[f]	0/0[f]	0/0[f]
Lopez Rock	ND	52/78 {22/ND}[1]	ND	0/34[f]	46/72[f]	32/53[f]
Rockland Landing North[5]	ND	{3/3}[1]	ND	0/0[f]	ND	0/0[f]
Plaskett Rock[5]	ND	386/437 {251/ND}[1] {266/ND}[2]	ND	0/17[e]	47/63[e]	63/106[e]
Cape San Martin	ND	341/460 {221/ND}[1] {154/36}[2]	ND	0/16[f]	388/746[f]	387/518[f]
Unnamed Rock	ND	125/186 {72/ND}[1] {124/289}[2]	ND	0/0[f]	0/0[f]	5/5[f]
Redwood Gulch Rock	ND	169/265 {143/ND}[1] {137/ND}[2]	ND	0/127[f]	126/268[f]	19/53[f]

Table 3 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Seastack S of Redwood Gulch	ND	{0/0}[1]	ND	0/-[f,4]	ND	42/44[f]
Unmapped Island	ND	14/25 {7/90}[1] {9/19}[2]	ND	0/4[f]	33/57[f]	10/24[f]
SAN LUIS OBISPO COUNTY						
3 Rocks	ND	{0/0}[1]	ND	0/-[f,4]	106/168[f]	14/15[f]
La Cruz Rock[5]	ND	308/408 {170/ND}[1]	ND	0/103[f]	0/43[f]	48/100[f]
Piedras Blancas Island	ND	1,194/1,377 {245/525}[1]	ND	267/663[f]	971/1,611[f]	1,005/1,171[f]
Morro Rock & Pillar Rock	ND	{63/82}[1,9]	ND	0/18[f,6]	92/169[f]	ND
Point Buchon	ND	{0/0}[2]	ND	ND	ND	ND
Pup Rock & Adjacent Mainland	ND	595/729 {140/ND}[1] {286/ND}[2]	ND	0/5[e]	559/1,060[e]	598/1,730[e]

Table 3 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Lion Rock[5,7]	ND	126/155 {58/72}[1] {21/22}[2]	ND	0/5[f]	281/522[f]	644/776[f]
Diablo Rock & Adjacent Mainland	ND	{7/12}[2]	ND	0/0[f]	0/0[f]	17/17[f]
Diablo Canyon N. P. P. South	ND	{0/0}[2]	ND	ND	ND	ND
Pecho Rock	ND	146/194 {90/100}[1] {ND/130}[2]	ND	17/70[f]	65/129[f]	89/114[f]
Point Arguello	ND	{0/0}[1] {0/0}[2]	ND	ND	ND	{15/-}[e]
Rocky Point	ND	{0/0}[1]	ND	ND	ND	{6/-}[e]
TOTAL	ND	8,900/11,091	ND	1,727/4,139	7,670/13,423	7,608/11,798

Footnotes:

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep).

Numerical Footnotes

See Table 2.

Table 4. Summary of the total numbers of Common Murres counted from aerial photographic and other surveys at breeding colonies in South-Central California, 1979-1987 (McChesney et al., in prep.; Manuwal et al., in prep.). Table format and symbols as in Table 2, except bold numbers represent best data. Aerial surveys were not conducted in 1983-1985.

	Year					
Colony Name	1979[a,b,h]	1980[a,b,c,h]	1981[c]	1982[c]	1986[f]	1987[f,g,h]
MONTEREY COUNTY						
Bench Mark-227x[g,10]	{0}[1]	ND	ND	ND	ND	ND
Castle Rocks & Mainland[11]	{1,524}[b(July)]	**{2,275}[a,b]** 1,098[(May)c] 795[(July)c]	1,198[(May)] 6,683[(June)]	**1,105[(June)]** 1,000[(May)]	ND	**954**
Hurricane Point Rocks[11]	{492}[b(July)]	**{1,400}[a,b(June)]** 1,427[(May)c] 1,144[(July)c]	**1,500[(June)]** 2,000[(May)]	**1,016[(June)]** 3,030[(May)]	ND	**310**

Footnotes:

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep); [h] Manuwal et al. (in prep).

Numerical Footnotes:

[10] Brandt's Cormorants nests/birds and Common Murres were observed at this colony in 1996 and 1997 (Parker et al. 1997, 1998).

[11] Sowls et al. (1980) reported the following earlier surveys: Castle Rocks and Mainland, 200 birds, 6 May 1970; and Hurricane Point Rocks, 400 birds, 6 May 1970.

Table 5. Summary of the total numbers of Common Murres counted from aerial photographic and other surveys at breeding colonies in South-Central California, 1988-1995. Table format and symbols as in Table 4. Aerial surveys were not conducted in 1983-1985.

	Year					
Colony Name	1988[f,g,h]	1989[d,g,h]	1990[f,g,h]	1993[e,g,h]	1994[e,g,h]	1995[e,g,h]
MONTEREY COUNTY						
Bench Mark-227x[10]	ND	{0}	ND	ND	ND	ND
Castle Rocks & Mainland[11]	**567**	**728**	**841**	**972**	**1,439**	**1,376**[(2 June)] 1,240[14 June)]
Hurricane Point Rocks[11]	**480**	**365**	**420**	**489**	**496**	**440**

Footnotes:

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep); [h] Manuwal et al. (in prep).

Numerical Footnotes:

See Table 4.

Table 6. Summary of the total numbers of roosting Brown Pelicans counted from aerial photographic and other surveys at cormorant and murre breeding colonies in South-Central California, 1979-1987. Numbers refer to roosting birds only but otherwise symbols as in Table 2.

	Year					
Colony Name	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
MONTEREY COUNTY						
Bird Rock	{P}	P[a]	ND	ND	ND	96[f]
Guillemot Island Area	{0}	ND	ND	ND	ND	ND
Pinnacle Point Area	{0}	ND	ND	ND	ND	ND
Bird Island	{100}	0[a]	1,538[(Oct)]	ND	ND	49[f]
Castle Rocks & Mainland[g]	{0}[a,1]	{0}[a,c]	0[g]	0[g]	0[g]	0[g]
Hurricane Point Rocks[g]	{0}[a,1]	{0}[a,c]	0[g]	0[g]	0[g]	21[g]
Cooper Point & Islands	{0}	ND	ND	ND	ND	ND
Pfeiffer Point	{0}	ND	ND	ND	ND	ND
Grimes Point	{48}[2]	ND	ND	ND	ND	ND

Table 6 (Continued)

Colony Name	Year					
	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
Lafler Rock & Mainland	{2}[1]	ND	ND	ND	ND	ND
Torre Canyon Rocks	{0}[1]	ND	ND	ND	ND	ND
Partington Ridge North	{0}[1]	ND	ND	ND	ND	ND
McWay Rocks	{4}[b]	ND	ND	ND	ND	ND
Partington Ridge South	{0}[1]	ND	ND	ND	ND	ND
Anderson Canyon Rocks	{0}[1]	ND	ND	ND	ND	ND
Burns Creek Rocks	{0}[1]	ND	ND	ND	ND	ND
Dolan Rock	{0}[1]	ND	ND	ND	ND	ND
Square Black Rock	{0}[1]	ND	ND	ND	ND	ND
Lopez Rock	{0}[1]	ND	ND	ND	ND	ND

Table 6 (Continued)

Colony Name	Year					
	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
Rockland Landing North	{0}[1]	ND	ND	ND	ND	ND
Plaskett Rock	{35}[1]	0[a]	ND	ND	ND	ND
Cape San Martin	{45}[1]	P[b]	ND	ND	ND	ND
Unnamed Rock	{0}[1]	ND	ND	ND	ND	ND
Redwood Gulch Rock	{0}[1]	ND	ND	ND	ND	ND
Seastack S of Redwood Gulch	{0}[1]	ND	ND	ND	ND	ND
Unmapped Island	{0}[1]	ND	ND	ND	ND	ND
SAN LUIS OBISPO COUNTY						
3 Rocks	{0}[1]	ND	ND	ND	ND	ND
La Cruz Rock	{0}[1]	ND	ND	ND	ND	ND
Piedras Blancas Island	P[1]	0[a]	0	0	ND	ND

Table 6 (Continued)

Colony Name	Year					
	1979[a,b]	1980[a,b,c]	1981[c]	1982[c]	1986[f]	1987[f]
Morro Rock & Pillar Rock	{117}[1]	ND	ND	ND	ND	ND
Point Buchon	{250}[1]	{0}[b,1]	ND	ND	ND	ND
Pup Rock & Adjacent Mainland	{250}[1]	ND	ND	ND	ND	ND
Lion Rock	{59}[1]	ND	743[(Oct)]	ND	ND	ND
Diablo Rock & Adjacent Mainland	{0}[1]	ND	ND	ND	ND	ND
Diablo Canyon N. P. P. South	{0}[1]	ND	ND	ND	ND	ND
Pecho Rock	{0}[1]	ND	370[(July)]	ND	ND	ND
Point Arguello	{0}[1]	ND	ND	ND	ND	ND
Rocky Point	{0}[1]	ND	ND	ND	ND	ND

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep); [h] Manuwal et al. (in prep).

Table 7. Summary of the total numbers of roosting Brown Pelicans counted from aerial photographic and other surveys at cormorant and murre breeding colonies in South-Central California, 1988-1995. Numbers refer to roosting birds only but otherwise symbols as in Table 2.

	Year					
Colony Name	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
MONTEREY COUNTY						
Bird Rock	336	{169}[1]	246	50[f]	12[f]	84[f]
Guillemot Island Area	0	0	0	0[f]	0[f]	0[f]
Pinnacle Point Area	0	{0}[1]	0	0[f]	0[f]	0[f]
Bird Island	171	{80}	77	0[f]	383[f]	539[f]
Castle Rocks & Mainland[g]	0[g]	0[g]	0[g]	0[e]	0[e]	0[g]
Hurricane Point Rocks[g]	0[g]	0[g]	0[g]	0[e]	0[g]	0[g]
Cooper Point & Islands	ND	{0}[1]	ND	ND	ND	ND
Pfeiffer Point	ND	{0}[1]	ND	ND	ND	ND
Grimes Point	ND	{0}	ND	0[f]	3[f]	0[f]

Table 7 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Lafler Rock & Mainland	ND	{0}	ND	0[f]	2[f]	0[f]
Torre Canyon Rocks	ND	{0}[1]	ND	ND	ND	ND
Partington Ridge North	ND	{0}	ND	0[f]	0[f]	0[f]
McWay Rocks	ND	{108}	ND	0[f]	0[f]	0[f]
Partington Ridge South	ND	{0}[1]	ND	0[f]	0[f]	0[f]
Anderson Canyon Rocks	ND	{0}	ND	0[f]	0[f]	0[f]
Burns Creek Rocks	ND	{0}	ND	0[f]	0[f]	0[f]
Dolan Rock	ND	{0}[1]	ND	0[f]	0[f]	0[f]
Square Black Rock	ND	{0}	ND	0[f]	0[f]	0[f]
Lopez Rock	ND	{0}	ND	0[f]	0[f]	0[f]

Table 7 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Rockland Landing North	ND	{0}[1]	ND	0[f]	ND	0[f]
Plaskett Rock	ND	{0}	ND	2[e]	0[e]	6[e]
Cape San Martin	ND	{68}	ND	0[f]	0[f]	0[f]
Unnamed Rock	ND	{0}	ND	0[f]	0[f]	0[f]
Redwood Gulch Rock	ND	{0}	ND	0[f]	0[f]	0[f]
Seastack S of Redwood Gulch	ND	{0}[1]	ND	0[f]	ND	0[f]
Unmapped Island	ND	{0}	ND	0[f]	0[f]	0[f]
SAN LUIS OBISPO COUNTY						
3 Rocks	ND	{0}[1]	ND	0[f]	0[f]	0[f]
La Cruz Rock	ND	{0}	ND	0[f]	0[f]	0[f]
Piedras Blancas Island	ND	{42}[1]	ND	0[f]	0[f]	0[f]

Table 7 (Continued)

Colony Name	Year					
	1988[f]	1989[d]	1990[f]	1993[e,f]	1994[e,f]	1995[e,f]
Morro Rock & Pillar Rock	ND	{76}[1]	ND	29[f]	15[f]	ND
Point Buchon	ND	{0}	ND	ND	ND	ND
Pup Rock & Adjacent Mainland	ND	{0}	ND	0[e]	0[e]	0[e]
Lion Rock	ND	{75}	ND	1[f]	0[f]	34[f]
Diablo Rock & Adjacent Mainland	ND	{0}[1]	ND	0[f]	0[f]	0[f]
Diablo Canyon N. P. P. South	ND	{0}[1]	ND	ND	ND	ND
Pecho Rock	ND	{0}	ND	0[f]	0[f]	0[f]
Point Arguello	ND	{0}[1]	ND	ND	ND	0[e]
Rocky Point	ND	{0}[1]	ND	ND	ND	0[e]

Alphabetized Sources: [a] Sowls et al. (1980); [b] Sowls et al. (unpubl. archive data); [c] Briggs et al. (1983); [d] Carter et al. (1992); [e] Carter et al. (1996); [f] Carter and Takekawa (unpubl. archive data); [g] McChesney et al. (in prep); [h] Manuwal et al. (in prep).

Table 8. Preliminary assessment of evidence of human disturbance at Brandt's Cormorant colonies in South-Central California, based on general colony trends, type of possible disturbance evidence available, and potential for disturbance related to the geographic location of the colony.

Colony Name[2]	Disturbance Evidence[1] 1979-1987	1988-1995	Brief Summary of Possible Evidence	Colony Trend Assessment[3]	Current Concern[4]
Bird Rock	A	A	Protected location[5]	1	No
Guillemot Island Area[a]	D	B	Protected location; low numbers in 1990	3[6]	No
Pinnacle Point Area[a]	A	B	Protected location; low numbers in 1989	3[6]	No
Bird Island	A	A	Protected location	1	No
Castle Rocks & Mainland[b]	C	A	Low numbers in 1980, 1982, and 1986	3[6]	High
Hurricane Point Rocks[b]	C	C	High numbers in 1979-1980; low numbers in most years 1981-1995	3,4[6]	High
Cooper Point & Islands	A	A	Small colony; not surveyed in 1993-1995	1	No
Pfeiffer Point	A	D	Small colony; no nesting in 1989; not surveyed in 1993-1995	4	High
Grimes Point	A	A	High numbers in 1994-1995	1	No
Lafler Rock & Mainland[c]	A	C	Low numbers in 1994-1995	4[6]	High
Torre Canyon Rocks[c]	D	D	No nesting in 1979 and 1989; not surveyed in 1993-1995	5[6]	High
Partington Ridge North[c]	A	B	Low numbers in 1994	3,4[6]	High
McWay Rocks[c]	A	D	No nesting in 1994-1995	3,4[6]	High
Partington Ridge South[c]	D	A	No nesting in 1979; no nesting in 1994; small colony	2,3[6]	High
Anderson Canyon Rocks[c]	D	B	No nesting in 1979; low numbers in 1995	2,3,4[6]	High
Burns Creek Rocks[c]	A	B	Low numbers in 1994	3,4[6]	High
Dolan Rock	D	D	No nesting all surveys 1979-1995	5	High
Square Black Rock	D	D	No nesting all surveys 1979-1995	5	High
Lopez Rock	D	A	No nesting in 1979-1980; first nesting in 1989	2	Medium

Table 8 (Continued)

Colony Name[2]	Disturbance Evidence[1] 1979-1987	1988-1995	Brief Summary of Possible Evidence	Colony Trend Assessment[3]	Current Concern[4]
Rockland Landing North	A	A	Small colony; no nesting in 1995	1,4	No
Plaskett Rock	D	C	No nesting in 1979-1980; recolonized in 1989; low numbers in 1994-1995	2,4	High
Cape San Martin[d]	A	A	High numbers all surveys 1979-1995	1	Medium
Unnamed Rock[d]	D	C	No nesting in 1979; recolonized in 1989; few in 1995	2,3,4[6]	Low
Redwood Gulch Rock[e]	A	B	Low numbers in 1995	3,4	Medium
Seastack S Redwood Gulch[e]	D	A	No nesting in 1979; first nesting in 1995	2,3	Medium
Unmapped Island	A	A	Small colony all surveys 1979-1995	1	Low
3 Rocks[f]	D	B	No nesting in 1979; first nesting in 1994; low numbers in 1995	2,4	High
La Cruz Rock[f]	D	C	No nesting in 1979-1980; low numbers in 1994-1995	2,4	High
Piedras Blancas Island	A	A	High numbers all surveys (protected location)	1	No
Morro Rock & Pillar Rock	D	C	No nesting in 1979; first nesting in 1989 (after protection)	2	No
Point Buchon[g]	B	D	No nesting in 1979 but small numbers in 1980; no nesting in 1989; not surveyed in 1993-1995	3,4[6]	Low
Pup Rock & Adj. Mlnd.[g]	D	A	No nesting in 1979-1980; first nesting in 1989 (after protection)	2[6]	Low
Lion Rock[g]	D	A	No nesting in 1979-1980; first nesting in 1989 (after protection); increasing in 1994-1995	2[6]	Low
Diablo Rock & Adj. Mlnd.[g]	A	C	No nesting in 1989, 1994 (after plant built); small numbers in 1995	3,4[6]	High

Table 8 (Continued)

Colony Name[2]	Disturbance Evidence[1] 1979-1987	1988-1995	Brief Summary of Possible Evidence	Colony Trend Assessment[3]	Current Concern[4]
Diablo Canyon NPP South[g]	A	D	No nesting in 1989; not surveyed in 1993-1995	3,4[6]	High
Pecho Rock	A	A	Moderate numbers all surveys	1	Medium
Point Arguello	D	A	No nesting in 1979-1980; first nesting in 1995 (after protection); small colony	2	Low
Rocky Point	D	A	No nesting in 1979; first nesting in 1995 (after protection); small colony	2	Low

Footnotes:

[1] Disturbance categories are coded: A, no evidence noted; B, relatively low numbers in one (non-El Niño) year and probable movement to nearby colony that may be related to human disturbance; C, relatively low numbers in more than one year that may be related to human disturbance; D, no nesting that may be related to human disturbance.

[2] Changes in numbers at colonies with lettered superscripts may involve shifts to nearby colonies with the same superscript.

[3] Preliminary trend assessments are coded: 1, stable; 2, re-colonization or increase between 1979-1987 to 1988-1995 periods; 3, probable "re-arrangement" through intra-colony complex movements; 4, decline or low numbers in 1988-1995 period; and 5, no re-colonization between 1979-1987 and 1988-1995 periods but earlier known nesting.

[4] Concern coded: No, protected location or no evidence of disturbance; Low, potential for disturbance from overflights or mainland but no evidence of disturbance; Medium, potential for disturbance from overflights and mainland and possible evidence of recent disturbance; High, potential for disturbance from overflights and mainland and probable evidence of recent disturbance.

[5] Protected locations occur in parks or near areas with coastal observers.

[6] Combined numbers of cormorant nests for colonies with the same lettered superscript appear to be roughly stable.