

Black Oystercatcher

Haematopus bachmani

FRENCH: *Huître de Bachman*; SPANISH: *Ostrero negro*
ALEUT: *He-gich, Hech, Hekh*; TLINGIT: *Lugan*; RUSSIAN: *Morskoï Ptóokh*

"Left to themselves, the birds are no Quakers, and the antics of courtship are both noisy and amusing."
(Dawson in Bent 1929)

The Black Oystercatcher is a conspicuous member of rocky intertidal communities along the west coast of North America. Completely dependent on marine shorelines for its food and nesting, this is a monogamous, long-lived bird. Breeding pairs establish well-defined, composite feeding and nesting territories and generally occupy the same territory year after year, often along low-sloping gravel or rocky shorelines where intertidal prey are abundant. Pairs nest just above the high-tide line and use the intertidal zone to feed themselves and provision their chicks. Diets of adults and chicks consist mainly of molluscs;

principally mussels and limpets. Parental feeding of offspring extends well after chicks develop independent flight.

Pairs often abandon their territories in winter and form flocks; in areas of high mussel density, these flocks often number in the hundreds. Human-induced

disturbances on islands where Black Oystercatchers nest have eliminated local populations.

Genus *Haematopus* is Greek for blood eye (red in Old World forms). Specific scientific name is by John J. Audubon for his friend, the Reverend John Bachman.

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Figure 1.

Distribution of the Black Oystercatcher. Only individuals in northern populations of this species are known to migrate. Becomes more localized throughout range during winter.

BLACK OYSTERCATCHER

DISTINGUISHING CHARACTERISTICS

Relatively large (42–47 cm long, 500–700 g), melanistic shorebird. Only shorebird in North America that is completely blackish. Head, neck, and breast black; back, abdomen, and wing-coverts grayish brown. Hindneck often appears ruffed. Long (6.5–8.5 cm), straight, orange-red bill with yellow tip. Bright yellow iris, orange-red orbital ring in adults. Sturdy, pale pink legs. Sexes mostly monomorphic in plumage but somewhat dimorphic in size. Females have longer, narrower bills and heavier bodies (Helbing 1977). Bare parts duller in subadults (1- to 2-yr-olds).

DISTRIBUTION

THE AMERICAS

Breeding range. Figure 1. Generally, along Pacific Coast of North America from Alaska to Baja California. Breeds west to Kiska, Aleutian I., AK (Niven and McClellan 1987) and north to Round I., Bristol Bay, AK (Eley 1976). Resident along Aleutian I., Alaska Peninsula, and southcoastal Alaska. Primarily along outer coast of se. Alaska, British Columbia, Washington (south to Point Grenville; Paulson 1993), Oregon, and in California from Del Norte Co. south to about Point Arguello, Santa Barbara Co. (Small 1994). Locally distributed resident on west coast of Baja California Norte and Baja California Sur south to Laguna San Ignacio, including offshore islands (Jehl 1985). Also resident on Farallon and Channel I. (except San Nicolas I.) (Small 1994). Summer visitor to w. Aleutian I., AK (Turner 1885 [but see Murie 1959], Byrd 1978), n. Bristol Bay, AK (D. Dewhurst pers. comm.), Cape Pierce, AK (L. Haagblom pers. comm.), and to Gulf of California (Russell and Lamm 1978). Only record away from coast was a bird captured "in distress" at 1,045 m in Cascade Mtns., WA, in Jan (Paulson 1993). A bird also was reported from Farmington Bay, UT, on 5 Aug 1949, but given this species' tendency not to leave coastal locations, this undocumented report has been questioned (Behle et al. 1985). A melanistic bird recorded as *Haematopus bachmani* in s. New Jersey in 1951 (Potter 1952) was possibly Blackish Oystercatcher (*H. ater*; from s. South America).

Winter range. Winter visitor to Pribilof I., AK (Rodstrom 1984), along coast of s. California, and increasingly within San Francisco Bay, CA (Small 1994). Otherwise resident throughout range. Pairs maintain year-round territories in southern part of range (Helbing 1977, Jehl 1985). Breeders on exposed outer coastlines, and in north, form flocks

at protected sites in winter. Aggregations usually number <100 birds but known to reach 140 birds in Masset, British Columbia (BC), 350 birds on Kodiak I., AK, and 600 birds in Glacier Bay, AK (Christmas Bird Counts, G. van Vliet pers. comm.).

OUTSIDE THE AMERICAS

Not reported.

HISTORICAL CHANGES

Because of remoteness of breeding and feeding habitats, no major contractions in range; most local changes involve human or human-induced disturbances (see Conservation and Management).

FOSSIL HISTORY

No fossil or prehistoric records. Nol and Humphrey (1994) describe fossil remains of an early *Haematopus* species from e. North America.

SYSTEMATICS

GEOGRAPHIC VARIATION

Varies geographically in color only. Populations from Alaska to about Oregon are entirely black, but clinal variation southward—increasing amounts of white feathers and browner (less black) abdomens (Jehl 1985). Black Oystercatcher differs from melanistic Old World forms by iris color (red in African Black Oystercatcher [*H. moquini*], Canarian Black Oystercatcher [*H. meadewaldoi*], Variable Oystercatcher [*H. unicolor*], and Sooty Oystercatcher [*H. fuliginosus*]) and from Blackish Oystercatcher by narrower bill and nonoverlapping range (Hayman et al. 1986).

SUBSPECIES; RELATED SPECIES

Delineation of species within genus *Haematopus* unclear since its generic designation. Based on sympatric and allopatric ranges, Heppleston (1973) recognized 2 melanistic species, 2 pied species, and 1-form species; he considered *H. bachmani* a subspecies of *H. ostralegus*. American Ornithologists' Union (1983) considered *H. bachmani* a full species, and the *ostralegus* complex, including American Oystercatcher (*H. palliatus*) and *H. bachmani*, a superspecies.

Ranges of *H. bachmani* and *H. palliatus frazari* (a pied form) overlap along Pacific Coast of Baja California. Although hybridization has occurred, particularly during periods of low population size, assortative mating of like forms is most prevalent (Jehl 1985). Positive assortative mating and historical maintenance of parental forms at individual sites suggest that *H. bachmani* and *H. palliatus frazari* are distinct species (Jehl 1985). Preliminary molecular

analysis indicates that *H. bachmani* is distinct from *H. palliatus* (A. Baker pers. comm.).

MIGRATION

Most individuals only undergo a postbreeding, short-distance migration coincident with flock formation; individuals generally remain near nesting areas (Nysewander 1977, Hartwick and Blaylock 1979, Falxa 1992). Individuals in northern populations, however, probably undertake migrations. Only 25% of the population breeding in Prince William Sound, AK, was located on a winter aerial survey; closest known wintering area was 485 km to southeast (Andres 1994b). Small flocks (usually <25 birds) recorded spring and fall migrating along outer coast of Alaska (Arneson 1978, V. Harke pers. comm., BAA). Flocks, consisting of nonbreeders and failed breeders, increase throughout Jul and Aug and depart Sep in Alaska (BAA). Flocks build throughout Sep and Oct in British Columbia and reach highest numbers in Nov (Campbell et al. 1990). First- and second-year birds appear to migrate with adults. Flock of 150 birds recorded in Naden Harbour, BC, in Mar (Campbell et al. 1990). Spring movements probably occur during early Mar; vacated territories are reoccupied during Mar and Apr (Webster 1941b, Purdy 1985).

Migratory flocks fly low, <1 m above surface of water, and seldom venture across land. Loose structure of flocks is linear or V-shaped (Helbing 1977, BAA). An individual banded at Bodega Bay, CA, was sighted 340 km to the north in Jul and then returned to banding site in Sep (Falxa 1992).

HABITAT

BREEDING RANGE

Restricted to marine shorelines; favors rocky shorelines. Nesting habitat, however, ranges from mixed sand and gravel beaches to exposed rocky headlands. Southern range limit coincides with change of rocky shores to sandy beaches (Jehl 1985). Breeders avoid vegetated habitats and are most abundant on nonforested islands. Highest breeding densities in Alaska, British Columbia, and Washington occur on nonforested islands dominated by shell or gravel beaches (Hartwick 1974, Nysewander 1977, Vermeer et al. 1992a, H. Lentfer pers. comm., BAA). Nesting densities in Glacier Bay, AK, were 10 times higher on sparsely vegetated islands than on heavily vegetated islands (H. Lentfer pers. comm.). In Prince William Sound, AK, nesting pairs ($n = 117$) distributed

along shorelines as follows: exposed rocky shores 10%, exposed wave-cut platforms 21%, mixed sand and gravel beaches 21%, gravel beaches 30%, sheltered rocky shores 15%, and sheltered tidal flats 3%. Pairs distributed fairly equitably between rocky (45%) and gravelly (55%) shorelines (BAA). In Alaska, California, and elsewhere, number of unvegetated, rocky islets is a good, positive predictor of breeding-pair density along steep, rocky shorelines (BAA, GAF). Common to all Black Oystercatcher habitat is presence of low-sloping or level substrates for feeding. High densities on Cleland I., BC, are attributed to an extensive intertidal feeding area (Vermeer et al. 1992a). Retreat of glaciers, which expose gravel moraines, and uplifting events of earthquakes create new nesting habitat in Alaska (H. Lentfer pers. comm., BAA).

SPRING AND FALL MIGRATION

Few data. In Alaska and British Columbia, staging birds use areas visited by winter flocks. Flocks in British Columbia congregate in areas of Pacific herring (*Clupea harengus*) spawn and occasionally feed on seaside golf courses during migration (Campbell et al. 1990).

WINTER RANGE

Although many individuals aggregate in sheltered areas, some flocks remain at exposed sites, nearby to breeding areas (Hartwick and Blaylock 1979). Individuals wintering in central California used sheltered bays only when exposed outer coast is battered during storms (Falxa 1992). In Alaska and British Columbia, wintering flocks favor tidal flats of protected bays and inlets, where mussel beds occur (Hartwick and Blaylock 1979, BAA).

FOOD HABITS

FEEDING

Main foods taken. Intertidal marine invertebrates, particularly bivalves and other molluscs (limpets, whelks, and chitons); also crabs, sea urchins, isopods, and barnacles. Contrary to species' English name, oysters rarely taken and unimportant in diet (Campbell 1966). See Table 1 and Appendix.

Microhabitat for foraging. Forages almost exclusively in intertidal habitats, on rocky shores exposed to surf action and on sheltered gravel, cobble, or sandy shores and mudflats of bays and sounds. Access to foraging habitat is strongly dependent on tides and surf action; most feeding is done at low tide. In central California, 93% of foraging is in areas washed intermittently by

waves; wave-splashed mussels gape more often and hence are more vulnerable to attacks of oystercatchers (Hartwick 1976, Falxa 1992).

Often forages (52–75% of foraging time) in mid-intertidal zone where bivalve populations, particularly sea mussel (*Mytilus californianus*) and bay mussel (*M. trossulus*), are dense (Groves 1982, Falxa 1992). Also on rocky substrates where limpets or chitons are numerous (Frank 1982, Groves 1982, BAA). Forages for limpets in high intertidal zone when lower zones are inundated (Falxa 1992). In protected waters, takes bay mussels, horse mussels (*Modiolus modiolus*), clams, and other bivalves from mud, gravel, sand, and cobble substrates (Butler and Kirbyson 1979, Hartwick and Blaylock 1979, BAA). Infrequently forages on sandy beaches for sand crabs (*Emerita analoga*) and on seaside golf courses for soil invertebrates or insects (Campbell et al. 1990, GAF). Along steep rocky shorelines, breeding birds may commute to feeding areas >1 km from their nest; often travel >200 m to gravel shorelines (Hartwick 1978, BAA). No sexual differences in selection of foraging substrate described.

Food capture and consumption. Bill morphology is important to capture of most prey types. Individual bird moves steadily through habitat while visually searching for prey. Often interrupts feeding (for a few seconds to >1 min) to evade waves, by leaping into air or retreating to higher ground, or to scan for predators. Locates mussel with valves separated and captures with quick jab of bill that severs adductor muscle. Removes soft parts with bill tips and ingests. Consumes mussels attached to substrate or detaches them for handling elsewhere; sometimes uses detachment method to carry whole mussels to young or away from active surf zone. Rarely hammers mussels with bill to fracture valves; observed once during >200 h of observation (GAF). Chips small holes in oyster shells to reach adductor muscle (Butler and Kirbyson 1979). Dislodges limpets and chitons from rocks with quick jabs of bill aimed at point where edge of shell meets substrate. Flips prey over onto dorsal surface and removes soft tissue; removal of chiton flesh sometimes requires several trials to locate appropriate rock to act as a vise. Because of handling difficulty, sometimes abandons captured chitons (BAA). Pries tenacious limpets or chitons off rock with bill tip. Punches holes in urchin tests with bill to access gonads. Sometimes manipulates blades of algae (e.g., *Fucus*, *Pelvetiopsis*) with bill to reveal prey. Rarely, locates benthic prey in sand or mud by probing or possibly by observing the siphon holes of bivalves (R. Campbell pers. comm., BAA).

Occasionally steals prey from other Black Oystercatchers and has prey stolen by gulls (Groves 1982, GAF). Nocturnal feeding not recorded.

DIET

Major food items. Central and n. California: sea mussels, limpets of genera *Lottia* (including *Collisella*) and *Acmea*, whelks (*Nucella* [= *Thais*] *emarginata*), purple urchins (*Strongylocentrotus purpuratus*), polychaetes (*Nereis* spp.), and crabs (especially *Oedignathus enermis*) (Helbing 1977, Morrell et al. 1979, Lindberg et al. 1987, Falxa 1992). British Columbia: sea mussels, limpets, crabs, chitons, and polychaetes (Hartwick 1976, Groves 1982). Alaska: bay mussels (and sea mussels in se. Alaska), horse mussels, clams (*Protothaca staminea*, *Saxidomus giganteus*), limpets (*Lottia*, *Tectura*), barnacles (*Semibalanus*, *Balanus*, *Chthamalus*), and chitons (*Katharina*, *Mopalia*) (Webster 1941a, 1951, BAA; also see Table 1). Exploits ephemeral food sources: coelenterates (*Vellella vellella*) that wash ashore periodically in California; also Pacific herring spawn (Campbell et al. 1990, GAF).

Quantitative analysis. Throughout range, small gastropod molluscs dominate diet numerically, but bivalves contribute most prey mass (see Appendix). In British Columbia and se. Alaska ($n = 1250$ and 487 , respectively), mussels (29.4%, 35%) and limpets (44.3%, 44%) are most important prey items (Webster 1941a, Hartwick 1976). In central California, diet does not vary markedly between seasons; in Prince William Sound, AK, winter residents concentrate in areas with dense mussel beds (Falxa 1992, BAA).

FOOD SELECTION AND STORAGE

Selects invertebrate species according to their availability in environment; prey selection is quite variable among nest sites in a region (see Appendix). Selects mussels, limpets, and whelks that are larger and more profitable than the average of those available in environment (Hartwick 1976, Groves 1982, Falxa 1992). Takes few limpets <10 mm, and rarely takes large bivalves (>70 mm); large bivalves appear difficult to handle and may trap a bird's bill. Selects mussels, when available, over other prey types (Hartwick 1976, Falxa 1992). On British Columbia mudflats, selects mussels over cockles (*Clinocardium nuttallii*) and other invertebrate prey (Hartwick and Blaylock 1979).

Black Oystercatcher predation influences distribution, abundance, and size structure of local limpet populations (Frank 1982, Marsh 1986, Hahn and Denny 1989); also suggested as a selective force on limpet shell morphology and polymorphism (Geisel 1970, Hartwick 1981,

Table 1. Percentages of prey, determined from collections of used shells, in diets of Black Oystercatchers breeding in different habitats in Prince William Sound, AK (BAA).

Shoreline Habitat of Nest Site	Cobble <i>n</i> = 148	Mixed Sand & Gravel <i>n</i> = 156	Sheltered Rocky <i>n</i> = 133	Exposed Rocky <i>n</i> = 98
PREY SPECIES				
Chitons	6.1	7.1	2.3	48.0
Bay Mussels	10.1	32.7	18.0	11.2
Horse Mussels	2.0	10.3	14.3	1.0
Clams	0.0	3.2	59.4	0.0
Limpets	81.8	46.8	6.0	39.8

Sorensen and Lindberg 1991). No record of food storage by any oystercatcher species.

NUTRITION AND ENERGETICS

Average sea mussel taken in California is 47 mm long, contains 0.46 g dry weight of soft parts, and yields 0.87 g/min handling time; average limpet yields 0.27 g/min, and average whelk 0.29 g/min (Falxa 1992). Mollusc prey contain 4.8–5.1 Kcal/g of dry weight (Menge 1972). Mean intake rate of birds > 2 yr old was 0.22 ± 0.17 g dry weight/min of foraging time (GAF).

In British Columbia, chicks developed searching and handling skills comparable to adults within 1 yr (Groves 1982). In California, older birds (>3 yr old) preyed on rarer items (urchins, crabs, polychaetes, whelks) more frequently than did younger birds; absence of urchins in diet of younger birds probably reflects handling difficulty (Falxa 1992). Speed in handling mussels detached during capture increases for birds ≥ 3 yr old, but birds quickly become efficient at handling attached mussels and other molluscs (Falxa 1992).

DRINKING, PELLET-CASTING, AND DEFECATION

Drinks from shoreside rivulets and springs; drinking often follows foraging bout. Periodically casts undigestible hard parts, e.g., fragments of limpet shells and gastropod radula, in an unconsolidated form. Both pellets and feces are hard to locate and not representative of diet, as many food items lack indigestible parts (GAF).

SOUNDS

VOCALIZATIONS

Development. Not described for this species.

Vocal array. All known vocalizations are

structurally simple; considered calls. Voice distinct, many calls loud and sharp. Terminology of Cramp (1983) is used for calls structurally similar to those of Eurasian Oystercatcher

CONTACT CALL. See Figure 2, bottom. Loud, sharp *keee* note, usually given singly or in series at 2- to 5-s intervals and lasting 0.3–0.4 s; sometimes a disyllabic *kee-ah*. Pitch rises and falls briefly with primary note in a broad band centered around 3.2 kHz. Given throughout year in variety of contexts; 1 to several calls appear to communicate information about a bird's location to conspecifics, particularly mates. Used on arrival and departure from high-tide roosts. Pairs call before departure from and approach to nest, mate, or territory; also during tandem flights (Helbing 1977, GAF). May call in flight when passing through a foreign territory. Difference in call note of male and female (male's higher-pitched and disyllabic) described from only 1 study (Helbing 1977).

PIPING. Figure 2, top. Distinctive series of sharp notes given rapidly by adult; 1–3 *whcees* followed by rapid series of *tees*, *whce*—*whce*—*tee-tee-tee*..., typically lasting 3 to >5 s. Cadence and intensity initially increase and taper off toward end. Call is quite variable but generally accompanied by stereotyped postures and motions: head and bill directed downward, bill typically opened, neck and shoulders hunched, posture fairly erect, bird bowing repeatedly while vocalizing, breast feathers fluffed, and belly sometimes sleeked (Miller and Baker 1980; also see Fig. 3). Piping birds often rotate in place or may run side by side with short, quick steps and with frequent 180° turns (Purdy 1985). Series of Contact Calls may grade into Piping, or Piping may grade into Contact Call series or sometimes into a less forceful, trilling *titititi*, lasting ≥ 3 s.

Piping Display is ubiquitous in genus and performed throughout year by both sexes; performed more by male (Helbing 1977, Purdy and Miller 1988). Has more than 1 function, most often associated with adults advertising or defending a territory (Hartwick 1974). Boundary disputes may involve individuals facing off by walking parallel to each other along boundary (Helbing 1977, GAF). Pair members often Pipe when reunited; Piping between mates is less intense than in territorial conflict. Piping often spreads contagiously within a pair or among pairs with nearby territories; >3 adults may Pipe simultaneously (Purdy 1985, BAA). Also Pipe in flight when escorting intruders out of territory (Webster 1941b, Purdy 1985, GAF).

ALARM CALLS. Variable, most common being single, sharp *keek* notes. Briefer and ending more

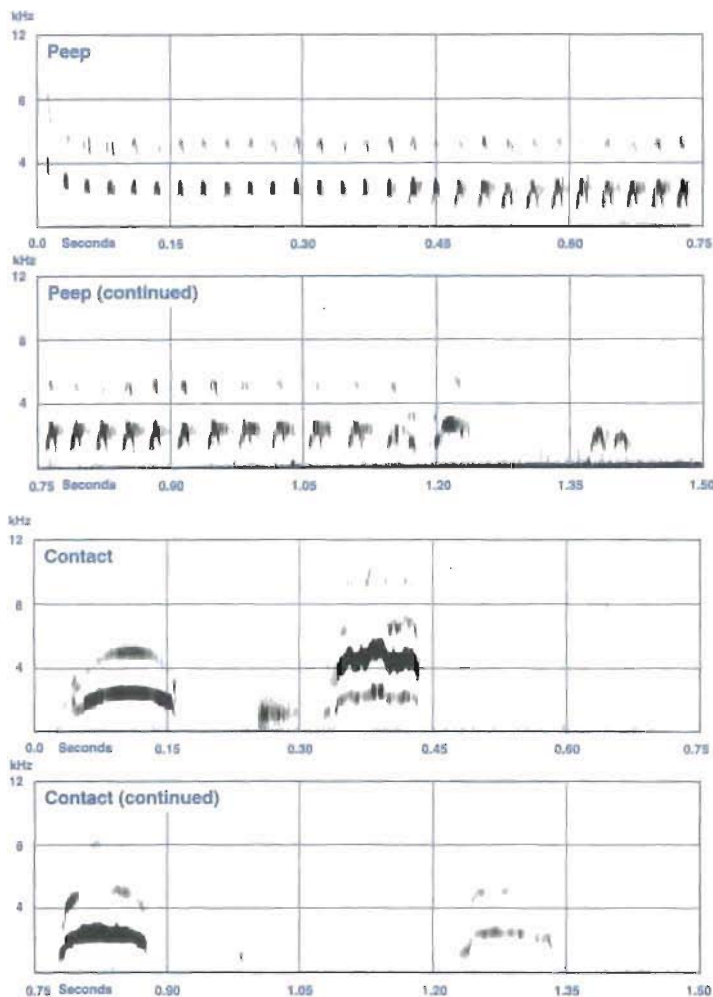


Figure 2. Calls of the Black Oystercatcher. Top: Piping Call (recorded by G. M. Bell, Library of Natural Sounds [LNS] #2920; British Columbia). Bottom: Contact Call (recorded by O. Hewitt, LNS #2921; British Columbia). Recordings courtesy of the Library of Natural Sounds (LNS), Cornell Laboratory of Ornithology. Sonograms courtesy of the Borror Laboratory of Bioacoustics, Ohio State University.

abruptly than typical Contact Call. Sometimes in multiples, especially as couplet; increased frequency and intensity of calls probably associated with higher levels of alarm (Miller and Baker 1980, GAF). Given when disturbed or threatened by other species, particularly around nest or young. A quavering *wic, wic-a-dee*, or *wic-a-dee-dee* sometimes given when interacting with other bird species (Helbing 1977). Nesting adults also give a rapid twitter or whinny (*whceteeteetee*) when attempting to decoy intruders from nest or when sending chicks to cover at nightfall (GAF).

MOUNTING CALL. A series of sharp *kip* notes; soft, high-pitched tittering; or a soft *pic-pic-pic* call given by male preceding copulation (Helbing 1977, Purdy 1985, GAF).

SOFT CONTACT CALL. Sharp *weep* rising in pitch at end, softer than other calls. Given as a contact call within pair or family group, particularly to summon chicks to food or out of hiding (BAA).

HATCHING CALL. Helbing (1977) describes 2 adult calls given during hatching, a soft *whEEP* call given near a nest with an egg and recently hatched chick, and a distinctive call resembling a combination of an American Coot's (*Fulica americana*) alarm call and a Common Loon's (*Gavia immer*) mating call.

CALLS OF YOUNG. Nestling calls not described. Fledged young use Contact Call.

Geographic variation. None described.

Phenology. Not well described; few differences between males and females noted. Individuals with active nests or young are most vocal. Contact Calls and *keek* Alarm Calls are used by hatching-year and older birds; in n.-central California, Piping is restricted to birds with adult plumage, and perhaps to territory holders (GAF).

Time and location of vocalizing. Structured largely by social context rather than circadian rhythm or location. Vocalizations typically associated with presence of intruders or mates on a territory, foraging area, or roost and are given either from the ground or in flight. Birds do not choose calling sites but call wherever interaction takes place. Nocturnal Piping reported from foraging areas in British Columbia and from nest sites in Alaska, but only rarely from n.-central California where night foraging not recorded (Purdy 1985, GAF, BAA). Countersinging and duetting not reported and probably do not occur.

NONVOCAL SOUNDS

None described.

BEHAVIOR

LOCOMOTION

Walking, hopping, climbing. Typically moves on ground by deliberately walking with strides 5–8 cm long at 1- to 2-s intervals (Helbing 1977). Rarely hops except when nestling or to avoid waves while foraging. Ascends steep slopes by walking and jumping, assisted by partly outstretched wings.

Flight. Normal flight with deep, rapid wingbeats. "Butterfly" flight (slow, stiff, deep wingbeats with wings raised high above horizontal) and "whir-flight" (shallow, rapid wingbeats) are often associated with pairing or territorial displays (Huxley and Montague 1925, Cramp 1983, GAF). Territorial disputes also involve acrobatic tail chases (Webster 1941b).

Swimming and diving. Adults swim by paddling with feet, usually only while bathing. Nonflying chicks occasionally evade potential predators by diving underwater and swimming on surface (Morgan 1994, GAF, BAA).

SELF-MAINTENANCE

Preening, head-scratching, bathing. Scratches head by raising leg over outstretched wing and by reaching lowered head over folded wing. In British Columbia, prenesting birds spending 12% of daylight in maintenance behaviors (preening, bathing, scratching) decreased activity to 5–7% during incubation and increased activity to 11% when chicks were ≥ 4 wk old. In California, territorial birds spent 7% of daylight preening and 0.2% bathing (Dec–Aug; Helbing 1977). Males spend same, or slightly more, time preening than females (Helbing 1977, Purdy and Miller 1988). Birds bathe in small pools or streams of fresh or saline water; appear to seek areas with freshwater inflows (Helbing 1977, GAF). No reports of anting or sunbathing. One individual used a limpet shell as a preening tool (Helbing 1977).

Loafing, sleeping, roosting. Diurnal activity pattern: forages during low tides, roosts at other times. Because distinguishing sleep from other loafing behavior is difficult, little information on sleep behavior; diurnal sleeping bouts appear short. In breeding pairs, nonincubating bird preens, loafs, rests, or remains alert when not feeding.

Inactive bird stands on 1 or both legs or sits. Usually holds head upright and alert with eyes open. May lay head across back with bill tucked under scapular feathers. May close eyes when bill is tucked but often keeps 1 or both eyes at least partially open. Individuals interrupt foraging to loaf on feeding grounds (usually <30 min), perhaps to permit digestion when satiated.

Nonbreeding birds typically roost communally. Daytime roosts are often near feeding areas, but birds may commute 1 km between sites (GAF). Roosts are located above wave zone or high-tide line and provide a wide view of nearby coastline. Traditional roosts are consistently occupied within a season and among years; repeated disturbance at a roost may cause abandonment for months or even years. Tide level and surf conditions determine timing of arrival and departure from roosts. In California, size and composition of roost flocks are highly plastic; dependent on surf conditions on exposed coast. Roosts are always larger during nonbreeding season. Territory-holding birds may roost singly or occasionally join communal roost. Roosts within an active territory are noisily tolerated by resident pair.

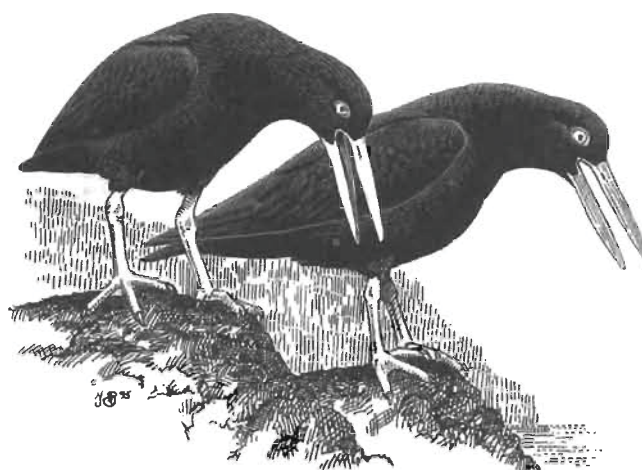


Figure 3. Black Oystercatchers engaged in a Piping Display; piping birds often rotate in place or run side by side with short, quick steps. Drawing by J. Schmitt.

In central California, Black Oystercatchers leave foraging areas 30–45 min after sunset to fly 4–5 km to nocturnal roosts (GAF).

Daily time budget. In British Columbia, time budgets vary among phases of nesting cycle and between sexes (Purdy and Miller 1988). During prenesting period: 41% of time foraging (females 45%, males 38%), 25–30% standing, 10–11% sitting, 11–12% preening, 2–3% in agonistic interactions, and 2–4% nest-building. Parental care, including incubation, increased and foraging time decreased as nesting cycle progressed.

In n. California from Dec to Aug, diurnal activities include: feeding (33–43%), sleeping (13–14%), resting (2%), standing (17%), preening (7–8%), flight (4%), and parental care (6% male, 9% female) (Helbing 1977). In Sonoma Co., CA, birds spend more of diurnal time foraging in fall and winter (39%) than in spring and summer (26%; Falxa 1992).

AGONISTIC BEHAVIOR

Piping (see Sounds: vocalizations; also Fig. 3) is most common communicative display given by breeding pairs. It is used as greeting between mates or as territorial display toward intruders. Many aggressive displays are used to defend territory or repel intruders from feeding areas. Aggressors stare (often with contour feathers erected), Pipe, rush toward intruder with bill forward, or rarely, may jab or grasp another bird with bill or strike with wings. Extended aerial pursuits of intruders by territorial birds are common, often accompanied by Contact Calls and Piping. Pursuits end when intruder is driven out of territory. Threatened or submissive birds may sleek head and other feathers, crouch with abdomen near ground, or tuck bill behind scapular feathers.

SPACING

Territoriality. NATURE, EXTENT, AND SEASONALITY OF TERRITORY. Composite nesting and feeding

territories established, usually maintained only among conspecifics. Territoriality is probably restricted to breeding-age birds; owing to delayed breeding, populations contain many individuals that do not hold territories.

In southern populations, territories are maintained year-round; resident pairs may stay on territory all year or may periodically visit and advertise territory in nonbreeding season. Intruders are tolerated much less in breeding season than in nonbreeding season. Territories established on exposed coasts are less likely to be maintained in winter than are territories on more protected shores (GAF, BAA).

MANNER OF ESTABLISHING AND MAINTAINING TERRITORY. Establishment of territories not described in detail. Because of longevity of birds and continuity of territory occupation within and across years, successful establishment of new territories is probably an uncommon event.

DOMINANCE HIERARCHIES. Dominance hierarchies exist within broods (Groves 1984; also see Breeding: young birds). Little is known about dominance relationships among adults. In Sonoma Co., CA, older individuals consistently dominate birds <3 yr old. Independent of age, birds feeding on own territory win most encounters; birds without a local territory are least likely to win encounters on feeding grounds (Falxa 1992).

INDIVIDUAL DISTANCE. Not studied in detail; birds commonly forage ≤ 5 m from each other and roost ≤ 1 m apart.

SEXUAL BEHAVIOR

Mating system and sex ratio. Monogamous; polygyny or polyandry not recorded. Sex ratio close to 1:1 (Webster 1941b).

Pair bond. **DURATION AND MAINTENANCE.** Paired birds remain together year-round. A small sample of color-banded birds in central California suggests that pairs remain together for years, perhaps for the lives of some birds. Some divorce occurs between breeding seasons (GAF). Pair members generally use same nest site for many consecutive years (GAF, BAA).

COURTSHIP DISPLAYS AND MATE GUARDING. Established pairs court on territory or at nest site (Helbing 1977). Mate guarding not well studied; 1 instance of incubating male vehemently chasing intruder that, when discovered, stood complacently by female (BAA).

COPULATION; PRE- AND POSTCOPULATORY DISPLAYS. Either sex initiates copulation. Vocalizations by both birds may precede copulation and include a "soft, repeated call" (Johnsgard 1981). Precopulatory behavior by female includes raising tail,

retracting neck, and lowering head and bill to horizontal position. Male approaches female from behind and mounts on platform formed by her back and tail, using partially extended wings to maintain his balance. Male and especially female often preen after copulation; no postcopulatory displays known.

Extra-pair copulations. Recorded once in British Columbia (Purdy 1985).

SOCIAL AND INTERSPECIFIC BEHAVIOR

Degree of sociality. Gregarious at roosts, particularly in nonbreeding season. May aggregate loosely on foraging areas, although not clear whether this is a result of patchiness of available prey or of social behavior. Contact Calls or Piping frequently accompany arrival or departure when other birds are present.

Play. None recorded.

Nonpredatory interspecific interactions. Foraging individuals may chase other birds feeding nearby, including gulls (*Larus* spp.), Willets (*Catoptrophorus semipalmatus*), Black Turnstones (*Arenaria melanocephala*), and Surf-birds (*Aphriza virgata*) (Helbing 1977, BAA, GAF).

Black Oystercatchers often nest near gulls and terns (*Sterna* spp.), occasionally <2–3 m away (Vermeer et al. 1992b, GAF, BAA). Association between Black Oystercatcher and larid nests apparently results from selection of similar nesting habitat rather than active selection of sites near nests of other species (Vermeer et al. 1992b). Black Oystercatchers respond to alarm given by gulls, but there is no apparent benefit for individual oystercatchers nesting near gulls in British Columbia; hatching success is higher for oystercatchers nesting near Arctic Terns (*Sterna paradisaea*) or Mew Gulls (*Larus canus*) in Prince William Sound, AK (Vermeer et al. 1992b, BAA). Adult Black Oystercatcher will use its bill to jab gull or tern chicks that wander into its territory (BAA).

PREDATION

Kinds of predators. Predation on free-flying Black Oystercatchers is poorly documented: in California, Peregrine Falcons (*Falco peregrinus*), and in Baja California, domestic cats (*Felis domesticus*) and coyotes (*Canis latrans*) are suspected as predators (Kenyon 1949, B. Walton pers. comm.).

Predation on eggs and young by birds and mammals is significant and, probably, a strong selective force for nesting on offshore rocks; nests are rare on accessible mainland sites (Nysewander 1977, Campbell et al. 1990, GAF). Nests on beaches accessible to mammalian predators had higher predation rate than nests on offshore rocks

(Vermeer et al. 1992b). Raccoons (*Procyon lotor*) suspected of being principal egg predator in British Columbia and California (Vermeer et al. 1992b, GAF). Other mammalian egg predators include striped skunk (*Mephitis mephitis*), American mink (*Mustela vison*), river otter (*Lutra canadensis*), sea otter (*Enhydra lutris*), red fox (*Vulpes vulpes*), arctic fox (*Alopex lagopus*), and possibly brown bear (*Ursus arctos*). Avian egg predators include Western Gull (*Larus occidentalis*), Glaucous-winged Gull (*L. glaucescens*), Northwestern Crow (*Corvus caurinus*), and Common Raven (*C. corax*) (Webster 1941b, Kenyon 1949, Vermeer et al. 1989, BAA, GAF). All egg predators prey on small chicks. Common Ravens, Bald Eagles (*Haliaeetus leucocephalus*), and possibly foxes take larger chicks (Webster 1941b, Nysewander 1977, BAA).

Response to predators. Incubating adult quietly leaves nest when approached by predator; after reaching a safe distance from nest, may give Alarm Calls from ground or in flight. Adults chase, and sometimes strike, aerial predators, attack terrestrial intruders, or sometimes feign broken wing. Adult may also silently hide behind rocks or vegetation, occasionally peeking around obstruction, or may feign incubation away from nest. Disturbed birds may engage in displacement behaviors (feeding, preening, copulation). Common Ravens and large *Larus* gulls are frequent objects of attacks; in one instance, members of 2 pairs of Black Oystercatchers knocked a gull from its nest and subsequently attacked it (Hartwick 1974). Adult oystercatchers can be chased away from their young by gulls (Hartwick 1974). Sensitivity to humans increases following negative interactions such as trapping adults or visiting nests. Breeding pairs increase their response intensity in latter stages of incubation and while chicks are young.

Roosting and foraging individuals may crouch silently, utter Alarm Calls, or, less frequently, take flight when raptors or other large birds appear overhead (GAF). Adults can escape pursuit by Peregrine Falcons by flying close to water; their shorter wings may enable them to fly closer to water than the falcons (B. Walton pers. comm.).

BREEDING

PHENOLOGY

Pair formation and nest-building. Pair establishment can be prolonged; pair behavior is shown by banded birds in their third year, ≥ 2 yr before age of first nesting (GAF). Where pairs maintain year-round territories, copulatory

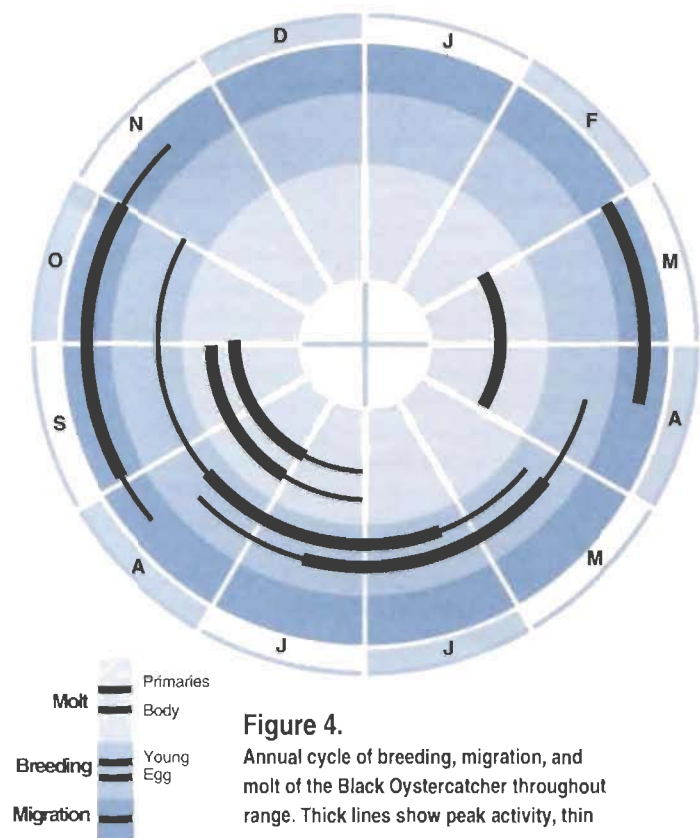


Figure 4.

Annual cycle of breeding, migration, and molt of the Black Oystercatcher throughout range. Thick lines show peak activity, thin

behavior begins in early Feb (Helbing 1977). In Alaska, pairs begin to establish territories in early to mid-Mar (Webster 1941b, S. McClellan pers. comm.). All territorial pairs are present on Cleland I., BC, by 15 Apr (Purdy 1985). Whether females or males arrive individually to establish territories is unknown; American Oystercatcher females arrive 3 wk before males and defend territories until their arrival (Baker and Cadman 1980). Pairs begin nest-building 1–3 wk before egg-laying and continue into incubation (Helbing 1977, Purdy 1985). That pairs are constantly together during prenesting and engage in many antagonistic interactions with conspecifics is thought to strengthen pair bond (Purdy 1985).

First/only brood per season. See Figure 4. Throughout range, most egg-laying in May and early Jun. Clutch initiation varies, at most, 15 d between southern and northern breeders (L'Hyver and Miller 1991). Clutches completed by 20 Apr in Baja California and occasionally by late Apr in British Columbia (Kenyon 1949, Hatler et al. 1978). Peak laying in Prince William Sound, AK, and n. California is third week of May (BAA, Helbing 1977); on Cleland I., BC, 72% ($n = 32$) of clutches laid from 15 May to 4 Jun (Vermeer et al. 1992a). Replacement clutches laid into mid-Jul on Cleland I., BC, and in Prince William Sound,

AK (Groves 1984, BAA). Nests with eggs found as late as 6 Aug in Alaska and 19 Aug in British Columbia (Webster 1941b, Campbell et al. 1990). Adults observed feeding young in early Nov in California (Williams 1927). Pairs evict offspring from territories during Jan and Feb following hatching (Helbing 1977).

NEST SITE

Selection process. Pairs consistently used same nest bowl 3 yr in Alaska and >5 yr in California (BAA, GAF). Sometime make multiple nests; female chooses in which one to lay (Webster 1941b, Purdy 1985). Breeding pairs appear to select territories that combine an appropriate nest site, usually located above highest high-tide level, with adequate foraging areas (BAA).

Microhabitat and site characteristics. Uses a variety of nest sites: sand and pebble beaches, shell beaches, cobble beaches, gravel outwashes, exposed rocky shorelines, wave-cut platforms, and offshore boulders. Unusual nest site: a gravel rooftop along waterfront in Nanaimo, BC (Campbell et al. 1990). Hatching success is higher on gravel than on rocky substrates on Destruction I., WA, but not in Prince William Sound, AK (Nysewander 1977, BAA). Eggs in successful nests are more similar to substrate (in particle size) than are eggs in failed nests (Nysewander 1977). Pairs generally avoid placing nest in vegetation; place beach nests to shore side of vegetation line (BAA). Substrate around nest site has sparse to no erect vegetation. In areas of little or no vegetation, nest is placed next to beach grass (*Elymus*) clump or rock (BAA). Incubating bird's view is often obstructed >180° by vegetation or rock. Lower peripheral view may also be obstructed. Nests located from <1 to 38 m above high tide (Helbing 1977). Nests <1 m from waterline are often flooded during extreme high tides. Several nests on glacial moraines in Glacier Bay, AK, were repeatedly subjected to tidal flooding (H. Lentfer pers. comm.). Height above and distance from water depend on specific location of nest site along beach or on rocks.

NEST

Construction process. Birds toss rock flakes, pebbles, or shell fragments toward nest bowl with a sideward and backward flick of bill; occasionally carry flakes and toss them forward from bill. Intermittent nest construction begins 2–3 wk before eggs are laid; can be accomplished in <1 h (Hartwick 1974). Male and female both participate in nest-building, but male does most of it. Female assumes increased role during incubation. Nest-building only occurs when both

mates are present and may strengthen pair bond (Purdy 1985). Nest bowl is made by pressing chest into nest material or fine-grained sediments. Like American Oystercatcher, Black Oystercatcher may use feet to excavate scrape in sand or sod (Nol and Humphrey 1994). Antagonistic interactions, usually initiated by male, are directed toward other Black Oystercatchers during prenesting (Purdy 1985).

Structure and composition matter. Variable. Ranges from bare rock or sod to a structure composed of hundreds of rock flakes and shell fragments. Most often consists of mixture of rock flakes and shell fragments. Less fabricated structure on sand/pebble or cobble beaches than on rock outcroppings. In Prince William Sound, AK, flake nests are constructed on moss (Bryophyta) growing on basaltic boulders (BAA). Eggs found in old Mew Gull nest and in nest made from broken mussel shells of a sea otter scat (BAA).

Dimensions. Extremely variable. Average nest diameter on Destruction I., WA, 20.5 cm; average depth 2.8 cm (Nysewander 1977). Deeper nests tend to be more successful (Nysewander 1977).

Microclimate. No specific information. Although Black Oystercatchers breed along rainy and windy coastlines, nests provide little protection from environment. Mounding of rock flakes for nests placed on impervious rock substrates may elevate eggs above pools caused by frequent summer rains (S. McClellan pers. comm.). Nests placed behind vegetation clump, log, or rock may reduce exposure to wind or visual predators (Vermeer et al. 1989).

Maintenance of nests, nonbreeding nests. Multiple nests, or scrapes, are made each season and accumulate in territory over time. Renesting females use same nest or lay in different one. Highly constructed nests on rock outcroppings are often used in subsequent years.

EGGS

Shape. Oval to pyriform. Mean width (maximum):length ratio is 0.69 ($n = 482$, range = 0.50–0.86 [BAA]). Egg shape 20% more variable among females than within clutches (BAA).

Size, mass, and volume. In Alaska ($n = 482$), 56.22 ± 2.34 (SD) \times 38.60 ± 1.44 mm (BAA). Average egg weight (g) at laying 46.0 ± 2.4 ($n = 23$); during incubation, eggs lose $1.50 \text{ g} \pm 0.25/\text{wk}$ (Nysewander 1977). Mean volume (cc) of eggs laid in first clutches 42.84 ± 3.06 ($n = 377$), equal to mean volume of eggs laid in second clutches (42.82 ± 5.16 , $n = 107$; BAA). Runt egg (38.9×28.1 mm) found with 2 normal-sized eggs in second clutch of pair nesting in Prince William Sound, AK

(BAA). In replacement clutches laid by same female, volume of largest egg can exceed volume of any in first clutch (BAA). Egg volume, predictably, is more variable (40%) among females than within a female's clutch. In American Oystercatcher, large females tend to lay large eggs (Nol et al. 1984). In Washington, heavier eggs produced chicks that had higher growth rates (Nysewander 1977).

Color and surface texture. Cream buff to olive buff, variably spotted, blotched, or scrawled with brownish black or purplish gray. Dark markings are often denser at larger end of egg. Surface texture slightly rough to smooth.

Eggshell thickness. No information.

Clutch size. One to 3 eggs. See Demography and Populations: clutch.

Egg-laying. Nest often is not finished before egg-laying. Eggs laid at about 24-h intervals (Nysewander 1977, Purdy 1985). Eggs covered only 30% of time, mainly by male, until clutch completed, but never left unguarded (Purdy 1985). Male is more alert near nest and more aggressive, mainly toward conspecifics, than is female. Before egg-laying, females spend more time feeding than do males (Purdy 1985). Copulation can occur within 2 h of losing clutch to predation (Purdy 1985). Single eggs lost from clutch are not replaced; loss of full clutch is normally replaced after 14 d. A female nesting on Mandarte I., BC, re-laid ≤ 11 d after losing a second clutch (Drent et al. 1964). Females can lay a third clutch after loss of first 2 (BAA).

INCUBATION

Onset of broodiness and incubation in relation to laying. Full-time incubation begins after clutch is complete.

Incubation patches. Not known. May be similar to lateral position of American Oystercatcher (Nol and Humphrey 1994).

Incubation period. Range 26–32 d, usually 26–28 d. High level of human disturbance increases incubation period (Nysewander 1997). Eggs laid first have longer lay-hatch interval; eggs are laid at 24-h intervals but hatch at 4-h intervals (Drent et al. 1964).

Parental behavior. Both sexes incubate. At first mostly female, but male equalizes duty later in incubation period. Eggs are covered 90–98% of time (Helbing 1977, Purdy 1985). They are uncovered only during incubation changes, brief muscular stretches, or interactions with conspecifics or predators. No diel pattern of sharing incubation duties as in other shorebird species (Purdy 1985). Incubation changes are frequent throughout day (7 changes during daylight hours;

Helbing 1977). Mates change even more frequently during low-tide foraging periods (maximum of 3 changes during 3 h around low tide; BAA). Incubation changes usually are initiated by external stimuli (conspecifics, predators, approach of mate). Occasionally, hunger appears to motivate incubating bird to call to mate for relief (BAA).

Hardiness of eggs. Eggs flooded by high tides have successfully hatched. Of 31 eggs ($n = 12$ nests) submerged 1–4 times during high tides in Glacier Bay, AK, 17 survived to hatch (H. Lentfer pers. comm.). Eggs displaced late in incubation period were incubated by adults where eggs were left by receding tides or were returned to nest.

HATCHING

Preliminary events and vocalizations. Star-shaped fractures appear on end of egg 2–3 d before hatching. Chicks are active and vocalize inside eggshell at this time. A distinct hole appears in eggshell <1 d before hatching (Legg 1954).

Shell-breaking and emergence. Eggs hatch within 4–6 h of each other, not necessarily in the order laid (Purdy 1985). Remaining eggs are incubated after hatching of first chick; chick is either brooded in nest with eggs or leaves nest bowl.

Parental assistance and disposal of eggshells. Parents dispose of eggshells, either by walking or flying, <25 m from nest. Shells of hatched eggs are never found in nest bowl (BAA).

YOUNG BIRDS

Condition at hatching. Mobile, heavily downy. Mass 32–36 g (Webster 1942, Nysewander 1977).

Growth and development. Mass initially drops after hatching until chick begins feeding. By 72 h, chick walks and swims competently; after 5 d, begins to peck at potential food items (Webster 1942). Gains in mass are more rapid than lengthening of bill and tarsi. Growth follows Gompertz curve (BAA). Maximum growth occurs between 14 and 21 d, when chicks can gain 9% of body mass/d (Nysewander 1977). Chicks that obtained mass of ≥ 200 g by 20 d had a greater chance of fledging than those <200 g. Mass gain and bill growth asymptotes at fledging (38–40 d).

Mass gain varies among broods of different sizes and within a brood by dominance rank (Groves 1984). At 14 d, average mass of chicks in 1-chick broods was greater than mass of those in 2-chick broods; differences persisted until fledging. Larger siblings interfere with food delivery to smaller siblings by reaching food-bearing parent first, chasing siblings enroute to parent, or stealing from them after they receive a food item (Groves 1984).

Control of body temperature. Conspicuousness of Juvenal plumage and cessation of adult brooding indicate that chicks probably develop control of body temperature by 21 d.

Behavioral response to predators. Young chicks respond to parental Alarm Calls by hiding under rocks, lying flat against substrate, or running short distances to cover. At >21 d, chicks tend to run from terrestrial predators; fleeing chicks seldom venture into heavy vegetation (BAA). If habitat restricts movement, older chicks (>25 d) crouch alongside or under boulders. Chicks >25 d old occasionally swim and dive to escape predators; chicks can swim underwater, using wings, for short distances (Morgan 1994, BAA, GAF).

PARENTAL CARE

Brooding. Newly hatched chicks are brooded almost continuously during first 24–48 h, intermittently until 20–23 d. Chicks initially are brooded under body, later under wings. Both mates brood but mostly female (63–87%); parents of 2-chick broods occasionally brood together (Helbing 1977, Purdy 1985). Brooding might occur throughout night (Helbing 1977). During nonfeeding periods, adult not brooding is usually nearby and alert.

Feeding. Chicks usually begin accepting food after 12–24 h old; a 3.5-h-old chick refused food brought by adult (Helbing 1977). One parent guards or broods chicks while other parent forages. In Prince William Sound, AK, pairs routinely travel >1.5 km to forage for themselves and chicks (BAA). Most provisioning of young chicks is done by male (Purdy and Miller 1988). Female delivers greater proportion of food items after chicks begin accompanying parents to feeding grounds (as early as 7 d). Older chicks are aggressive in acquiring food from parents; a 25-d-old chick placed its bill within millimeters of adult's bill as it waited for barnacle (*Balanus*) pieces being removed by adult (BAA).

Parental hunger motivates chick feeding; occasionally a neglected chick will call for food (Groves 1984, BAA). Chicks generally fed flesh of marine molluscs (Appendix). Food items delivered to chicks range from <10-mm limpets to 60-mm clams; large items are cut into smaller pieces for chicks. On Southeast Farallon I., CA, adults fed chicks tenebrionid beetle larvae captured in soil of nearby seabird colony (Morrell et al. 1979). Parents vary in amount of care they provide; some routinely satiate chicks and others will neglect chicks to point of starvation. In Prince William Sound, AK, 2 parents delivered 88 items to two 18-d-old chicks in 3 h, whereas a nearby pair delivered only 5 items to 3 chicks in 3 h (2 of these chicks eventually starved); both pairs were

experienced breeders (BAA). Chicks are often fed items that adult was feeding on prior to delivery. Although chicks begin foraging for small prey items at 10 d, acquisition of foraging skills is slow; 50-d-old chicks receive >50% of their nutritional biomass from parents (Groves 1982). Items fed on by chicks <50 d old were less energetically profitable than items provided by their parents (Groves 1982).

Nest sanitation. Because chicks leave nest bowl soon after hatching, nest sanitation is not a concern of Black Oystercatcher parents. Chicks do not produce fecal sacs and freely excrete on nest rocks and in intertidal feeding areas.

COOPERATIVE (OR COMMUNAL) BREEDING

Egg dumping only reported at Sitka, AK; 2 females laid a total of 6 eggs in a single nest (Webster 1941b).

BROOD PARASITISM

Not known to host any brood parasites.

FLEDGLING STAGE

Chicks can leave nest bowl within 1 d of hatching. Capable of flight at 38–40 d but remain with parents in territory; accompany parents on flights to remote foraging areas. Excessive human disturbance prolongs fledging (i.e., independent flight) (Nysewander 1977). Chicks that grow slowly appear to stay in territory with parents longer (BAA). By time of first flight, chicks abandon crouching or fleeing as a predator response.

IMMATURE STAGE

Chicks move to staging grounds with adults and most likely migrate with them. Parents observed to feed chicks >120 d old (Williams 1927). By midwinter, foraging efficiency of chicks is slightly below that of adults (Groves 1982, Falxa 1992). Immature birds take >3 yr to develop complete repertoire of efficient foraging skills (Falxa 1992). Young birds occasionally steal food from other young or from adults on winter feeding areas (Groves 1982). Past year's offspring are ejected from parental territories when courtship intensifies during Jan–Mar (Helbing 1977). Flocks containing nonbreeding and second-year birds are present in breeding areas throughout summer. Prebreeding pairs establish territories but do not raise young.

DEMOGRAPHY AND POPULATIONS

MEASURES OF BREEDING ACTIVITY

Age at first breeding; intervals between breeding. Little information across range. On

Table 2. Clutch size, breeding success, and density of breeding Black Oystercatchers throughout their range. Data shown as mean (*n*).

LOCALITY	Clutch Size	Percent Hatched	Percent Fledged	No. of Young/Pair	Pairs/km of shoreline	Source
	<i>n</i> = clutches	<i>n</i> = eggs laid	<i>n</i> = eggs laid	<i>n</i> = pair-seasons	<i>n</i> = years	
WASHINGTON Destruction I.	2.15 (26)	70 (56)	37 (56)	0.95 (22)	4.58 (2)	Nysewander 1977
BRITISH COLUMBIA Cleland I. Mandarte I.	2.07 (410) 2.57 (28)	34 (614) 56 (57)	12 (339) 39 (19)	0.25 (155) 0.70 (10)	17.60 (6) 1.25 (5)	Vermeer et al. 1992a Drent et al. 1964
ALASKA Sitka Western Prince William Sound Eastern Prince William Sound	2.69 (13) 2.44 (128) 2.38 (193)	37 (314) 38 (460)	12 (311) 31 (450)	0.42 (24) 0.29 (130) 0.68 (206)	0.94 (1) 0.09 (3) 0.63 (3)	Webster 1941b BAA BAA

Farallon I., CA, first breeds at 5 yr (W. Sydeman pers. comm.). Once individuals reach breeding age, they probably breed every year.

Clutch. Individual females lay 1–3 eggs, rarely 4. A single 5-egg clutch was recorded in California (Zerlang and Fraser 1940). Average size of first clutches is rather invariant across species' range (L'Hyver and Miller 1991; also see Table 2). Clutch size is the least temporally and geographically variable parameter of reproductive success. Modal size of initial clutches is 3 eggs (*n* = 260) in Prince William Sound, AK (BAA). Replacement clutches tend to be smaller (2.33 eggs, *n* = 61) than initial clutches (2.42 eggs, *n* = 260). Third replacement clutches were recorded twice in Prince William Sound and contained 1 egg and 2 eggs (BAA).

Annual and lifetime reproductive success. Hatching success (eggs laid that hatched): 34–70% across range (Table 2). Hatching success variable among years at Cleland I., BC (25–71%) and at Destruction I., WA (62–77%). Nest success (proportion of females that successfully hatched a clutch from first or second attempts): 54% in western (*n* = 105 female-seasons) and 62% in eastern (*n* = 175 female-seasons) Prince William Sound, AK (BAA). Nest success of females that laid replacement clutches was lower than that of females that retained initial clutches in western (–20%) and eastern (–10%) Prince William Sound (BAA). Fledging success (eggs laid that fledged): 12–39% across range (Table 2). Probability of female raising a successful brood: 37% (SD =

34%; *n* = 11) on Cleland I. (1975–1978) and 52% (38%; 57) in eastern and 24% (26%; 33) in western Prince William Sound (Groves 1982, BAA). Within a single year, proportion of successful females varies markedly (10–70%) among islands in Prince William Sound (BAA).

Annual reproductive success (young/pair) ranges from 0.25 to 0.95 across range (Table 2). Yearly variation 0.19–0.31 (*n* = 3) on Cleland I., BC, and 0.4–1.4 (*n* = 2) on Destruction I., WA (Nysewander 1977, Vermeer et al. 1992a). No information on lifetime reproductive success of individuals.

Number of broods normally reared per season. Because of long duration of parental care, only 1 brood is raised per season.

LIFE SPAN AND SURVIVORSHIP

Banded birds found on Cleland I., BC, were 11 yr and possibly 16 yr old (Purdy 1985). Five chicks banded on Farallon I., CA, lived 15.5, 15, 12, 12, and 9 yr (W. Sydeman pers. comm.). Few data on postfledging or adult survival. Based on resighting data, annual survivorship of birds >1 yr in California (*n* = 26): >90%, at a minimum (GAF). Resighting information tends to underestimate survivorship.

DISEASE AND BODY PARASITES

No information reported. Extensive bill deformity found in chick hatched in Prince William Sound, AK (BAA). Black Oystercatchers feeding on mussels in central California safely

ingested doses of paralytic shellfish poisoning (PSP) toxins that are lethal to most other vertebrates (770–3,060 µg toxins/kg of oystercatcher body mass consumed during single feeding; GAF).

CAUSES OF MORTALITY

Predation is major cause of mortality of eggs and chicks; chicks are most vulnerable during first 2 wk after hatching (Groves 1982). Clutches and chicks are regularly lost to high tides or storm surges (<10% of all losses). Chicks raised near pinniped haul-outs occasionally are crushed (Warheit et al. 1984). Adults are relatively immune to predation; they are rarely pursued but wary of overflying raptors (Helbing 1977, BAA). No lethal interspecific interactions documented. Nothing known about mortality of adults or immatures caused by stresses of winter.

RANGE

Natal philopatry and dispersal. Although nonbreeding flocks, including second-year birds, often use traditional feeding and roosting areas near natal sites, no individual has been known to breed at its specific natal site. No hatching-year birds banded on Cleland I., BC, from 1970 to 1972 were found breeding during 1976–1978 (Groves 1982). Young birds banded in Farallon I., CA, are repeatedly reported 50 km from natal sites (W. Sydeman pers. comm.). At least 2 birds banded as chicks on Farallon I. were reported on California mainland but later returned to Farallons (DeSante and Ainley 1980). A winter record from St. Paul, AK, 450 km north of normal range, indicates that individuals are capable of dispersing long distances across water (Rodstrom 1984).

Fidelity to breeding site. Although long-term information on marked adults is limited, pairs appear to use same territories year after year. Three pairs on Cleland I., BC, defended same territories after for 7 yr (Groves 1982). Consistent territory occupation for 3 yr is common in Prince William Sound, AK, and for >5 yr in central California (BAA, GAF). No shifts in territories were observed in 4 yr at Cleland I., BC (Groves 1982). One nest site occupied in n. California in 1975 had been occupied 10 yr earlier (Helbing 1977).

Home range. Pairs defend composite feeding and nesting territories. Where feeding areas are separated from nest site, defense is most intense close to nest site. Territory shapes are amorphous, and size is difficult to assess. Where pairs nest along linear shorelines and territories are adjacent, territory size ranges were: 17–37 ha in n. California, 0.79–1.84 ha on Destruction I., WA, and 0.06–0.12 ha on Cleland I., BC (Helbing 1977,

Nysewander 1977, Purdy 1985). Cleland I. pairs supplemented territories by feeding at remote sites. In Prince William Sound, AK, many pairs use remote feeding sites; one pair used 9 remote feeding sites that required flying a total of 6.3 km to reach them (BAA).

Winter site fidelity. Throughout range, aggregations use traditional feeding and roosting areas. For 3 yr, banded individuals consistently returned to wintering areas in Bodega Bay, CA (Falxa 1992). Individuals breeding on exposed outer coastlines favor wintering in more protected sites. Mussel beds may be an important determinant of winter site selection and fidelity (Hartwick and Blaylock 1979, BAA).

POPULATION STATUS

Numbers. Throughout range, uncommon and patchily distributed. Western hemisphere population probably <11,000 individuals (Page and Gill 1994; also see Table 3). Species is regularly recorded on only small numbers of Christmas Bird Counts in Alaska (8), British Columbia (12), California (22), Oregon (6), and Washington (5). Generally recorded in small numbers (<25 birds); only 2 counts in Alaska (Kodiak, Narrow Cape) and 1 in British Columbia (Skidegate Inlet) average >100 birds.

Density. Breeding density (pairs/km) varies markedly among habitat types throughout range; can differ by magnitudes (Table 2). Density along rocky shorelines of Strait of Georgia, BC (0.06), San Juan I., WA (0.07), and w. Prince William Sound, AK (0.09), is probably typical of outer coastline of e. North Pacific (Vermeer et al. 1992b, BAA). Small islands with ample feeding areas tend to support higher densities of breeding pairs in w. Prince William Sound (0.63; BAA), Channel I., CA (0.66), and Destruction I., WA (4.56) (BAA, Warheit et al. 1984, Nysewander 1977). Density of breeding pairs is highest on Cleland I., BC (14.0–22.8; Vermeer et al. 1992a) and on small islands in Glacier Bay, AK (10.8–53.5; H. Lentfer pers. comm.).

POPULATION REGULATION

Availability of suitable shoreline along coast of w. North America probably limits population size on a broad scale. On a local scale, marked differences in breeding-pair density suggest limits to availability of high-quality feeding and nesting habitat. Predation during early life-stages (egg to 14-d-old chick) is most important component of mortality. Large colonies of Glaucous-winged Gulls can preclude, or displace, breeding Black Oystercatchers and eat eggs and young. Increases in number of gulls nesting on Cleland I., BC, correlated with decreases in population of breeding Black Oystercatchers

Table 3. Rangewide population estimates (number of individuals) for Black Oystercatchers.

LOCATION	POPULATION ESTIMATE	SOURCE
Baja California	100	Jehl 1985
California	700–1,000	Sowls et al. 1980
Oregon	350	NOAA* and USFWS* 1991
Washington	250–350	Nysewander 1977, Speich and Wahl 1989
British Columbia	1,000–2,000	Campbell et al. 1990, Jehl 1985
Southeast Alaska	1,000–2,000	Brad A. Andres
Southcentral Alaska	1,500–2,000	Brad A. Andres
Southwest Alaska/Aleutian Islands	2,000–3,000	Brad A. Andres
Total	≤11,000	

*NOAA = National Oceanic and Atmosphere Administration and USFWS = U.S. Fish and Wildlife Service

(Vermeer et al. 1992a). In Prince William Sound, AK, Black Oystercatcher productivity was inversely correlated with Common Raven abundance (BAA). The combination of shoreline habitat configuration and predator abundance results in formation of local source and sink populations. Intraspecific competition for nest sites or feeding areas in high-quality habitats is unimportant; productivity shows no pattern with nearest-neighbor distance (BAA). In some parts of range, human-induced disturbance is most important limiting factor for population growth (see Conservation and Management).

CONSERVATION AND MANAGEMENT

EFFECTS OF HUMAN ACTIVITY

Human and other mammalian disturbances. Scientific collecting, human disturbance, and mammalian predation have caused extirpation of breeding pairs on small islands off coast of Baja California (Kenyon 1949, Jehl 1985). Reduction in populations of the pied American Oystercatcher (*H. p. frazari*) and melanistic Black Oystercatcher led to increased hybridization among the forms. Human disturbance and feral cat predation on Channel I., CA, caused breeding pairs to abandon nest sites; density of breeding birds on disturbed islands was only 3% of density on undisturbed islands (Warheit et al. 1984). Human disturbance also caused a shift in breeding and haul-out sites of sea lions (*Eumatopius jubata*, *Zalophus californianus*) and elephant seals (*Mirounga angustirostris*) which in turn displaced breeding Black Oystercatcher pairs or crushed eggs and chicks of successful pairs (Warheit et al. 1984). For 100 yr, disturbance by humans and

domestic animals precluded Black Oystercatchers from breeding on South Farallon I., CA; 20 breeding pairs were reestablished within 5–7 yr after major disturbances were eliminated (Ainley and Lewis 1974). A similar response was noted on Destruction I., WA, where breeding pairs increased from 4 to 12 within 7 yr of lighthouse automation (Nysewander 1977). Species is now colonizing sites along inside waters of British Columbia that were previously unused (R. Campbell pers. comm.). Human-induced habitat alteration may have caused local extirpations from islands around Sitka, AK; breeding numbers declined from 102 individuals in 1940 to 4 individuals in 1985 (J. Webster pers. comm.).

Introduction of red and arctic foxes caused local extirpation of breeding Black Oystercatchers from islands along Alaska coast. Presence of Black Oystercatchers on islands in Aleutian chain is a good indicator of absence of foxes (E. Bailey pers. comm.). Beach-foraging habits of foxes make Black Oystercatcher eggs and chicks particularly vulnerable; remains have been found in droppings of foxes on Aleutian I. (Murie 1959). Introduction of rats to remote breeding islands, via shipwrecks, could also negatively affect breeding birds.

The Exxon Valdez oil spill. On 24 March, 1989, the T/V *Exxon Valdez* ran aground in n. Prince William Sound, AK, and released 42 million liters of Prudhoe Bay crude oil into the marine environment. The spilled oil affected breeding Black Oystercatchers in several ways: direct mortality (20% of population inhabiting the spill zone), disruption of breeding activity (39% of pairs on heavily oiled shorelines), and reduced survival of chicks. Cleanup activities disrupted breeding birds into 1990; survival of chicks in disturbed nests was much lower than in undisturbed nests. Hydrocarbon concentrations in some

oiled mussel beds may provide a chronic source of exposure to oil for this oystercatcher (Andres 1994a).

MANAGEMENT

Except for southern populations, species is relatively secure throughout range. Most management concerns involve local problems. Removal of foxes, feral pets, and livestock from breeding islands would greatly enhance local populations. Because rats can devastate island-nesting seabirds, procedures are being developed to minimize transfer of rats from shipwrecks to islands in Bering Sea and Gulf of Alaska (A. Sows pers. comm.). Throughout Black Oystercatcher's range, high water quality should be maintained in feeding areas to ensure healthy prey populations. Where excessive beach debris has eliminated nesting sites, removal may be warranted (J. Webster pers. comm.). Areas hosting high breeding and wintering densities should be identified and their protection assured. In non-breeding season, buffer zones restricting boat and human traffic could be established around feeding and roosting concentrations. In areas at risk to large-scale environmental perturbations (e.g., oil spills), baseline information on breeding density, non-breeding population size, reproductive success, prey abundance, and prey quality should be collected.

APPEARANCE

Specific color nomenclature is capitalized; parenthetical numbers refer to colors described by Smithe (1974, 1975, 1981). Uncapitalized colors represent closest approximations. All descriptions of molt and plumage follow Webster (1942).

MOLTS AND PLUMAGES

Hatchlings. Natal down mottled Black and Drab (27), narrowly tipped with Buff (24). Indistinct Black loreal, auricular, and median stripes merge on hindneck; 2 distinct Black stripes on back from hindneck to rump. Down of foreneck and chest Medium Neutral Gray (84); abdomen White. Tail and proximal thigh Black.

Juvenal plumage. Prejuvenal molt complete. Juvenal plumage first develops from dorsal and ventral tracts at 12 d; primary remiges pierce skin. By 21 d, Juvenal primary remiges, secondary remiges, secondary coverts, scapulars, and rectrices conspicuous; feathers emerge from capital tracts. Tips of feathers on rump, neck, flanks, and legs remain downy through 28 d. Primary remiges lengthen rapidly from 28–35 d, and Juvenal plumage is complete by 42 d.

In fresh Juvenal plumage: head and neck Jet Black (89); body and upper wing surface Dark

Grayish Brown (20); under wing surface Light Neutral Gray (85) to Dark Neutral Gray (83); anal circlet White tipped with Tawny (38). Feathers of rump, flank, abdomen, and scapulars, under-tail coverts, and upper wing coverts edged with Tawny. Tips wear and fade as juvenile ages, virtually gone by 3 mo. Jet Black fades to Black. At this time, Juvenal plumage identical in appearance to Definitive Basic plumage.

Basic I plumage. Occurrence or completeness of Prebasic I molt uncertain. Partial Prebasic I molt of body feathers, scapulars, and wing-coverts described in Bent (1929) inferred from American Oystercatcher. Alternatively, plumage might proceed directly from Juvenal to Alternate I (Webster 1942).

Alternate I plumage. Prealternate I molt partial. Feathers of back, rump, breast, flanks (and possibly head and neck), scapulars, outer tertials, axillars, upper-tail coverts, and under-tail coverts replaced Jan–Mar (6–9 mo old). Color of replacement feathers Fuscous (21), same as Definitive Alternate plumage of adult. No light feather edgings except on abdomen.

Basic II plumage. Prebasic II molt complete; May–Aug for first-year birds (earlier than in adults). Plumage same as Definitive Basic (see below).

Definitive Alternate plumage. Definitive Prealternate molt partial; occurs Apr and May. Geographically variable; northern populations replace all feathers but primary and secondary remiges, southern populations molt only scattered body feathers.

Alternate plumage lighter than Basic plumage. Except for upper-tail coverts, Dark Grayish Brown feathers of Definitive Basic plumage are replaced by lighter Fuscous feathers in Definitive Alternate plumage. Light Neutral Gray feathers of Basic underwing plumage replaced by Pale Neutral Gray (86).

Definitive Basic plumage. Definitive Prebasic molt complete; occurs Jul–Sep (later than Prebasic molt in second-year [younger] birds). Head and neck Jet Black. Back, rump, abdomen, flank feathers, upper-tail coverts, under-tail coverts, scapulars, axillars, upper wing coverts, and upper surface of secondaries Dark Grayish Brown. Underparts grade from Jet Black in foreneck to Dark Grayish Brown in abdomen, feathers of lower abdomen narrowly tipped with White. Rectrices and upper primary remiges grade, proximally to distally, from Dark Grayish Brown to Black. Under surface of wing grades from Dark Neutral Gray of primary remige tips to Light Neutral Gray of greater coverts to Dark Grayish Brown of marginal coverts. Anal circlet feathers dark.

BARE PARTS

Bill and gape. Bill Sepia (119) with white egg tooth at hatching, egg tooth lost after 7–12 d. Bill

Table 4. Linear measurements (mm) and mass (g) of adult female, adult male, and hatching-year Black Oystercatchers. Data shown as mean (SD; *n*).

Sex/Age	Bill	Bill Depth : Length	Wing	Tarsus	Mass
Females ¹	73.6 (3.3; 60)	0.17 (0.01; 60)	247.5 (7.3; 60)	53.1 (2.0; 60)	
Males ¹	68.3 (4.2; 74)	0.18 (0.01; 73)	245.0 (6.1; 68)	51.9 (1.8; 75)	
All adults ²	73.5 (4.7; 14)		247.9 (6.5; 14)	53.8 (2.5; 13)	554.9 (47.9; 14)
Hatching year ²	70.9 (6.3; 9)		246.2 (5.2; 9)	54.3 (2.5; 8)	514.4 (45.2; 9)

¹Adult measurements from Jehl 1985.²Winter measurements from Falxa 1992.

becomes increasingly Chrome Orange (16) at proximal end as chick ages, but retains sepia distal tip. At 90 d, proximal half of bill chrome orange. Second-year birds retain sepia bill tip. Adult bill Flame Scarlet (15) with Orange Yellow (18) tip. Sulphur yellow (157) gape at hatching changes to Flame Scarlet in adult; mouth lining from warm buff (118) to Flame Scarlet.

Iris and orbital ring. At hatching, iris raw umber (223), turns cinnamon rufous (40) by 28 d and buff by 90 d. Iris of second-year and older birds Spectrum Yellow (55) centrally and Orange Yellow peripherally. Orbital ring brightens from raw umber at hatching, to burnt orange (116) at 28 d, to Flame Scarlet in adult. Three age classes can be distinguished by combination of bill and iris color: hatching year, second year, and after second year.

Legs and feet. Drab gray (118) at hatching, becoming variably Flesh (5) and Pearl Gray (81) in adult. Nails Medium Neutral Gray proximally to Blackish Neutral Gray (82) distally.

MEASUREMENTS

Sexually dimorphic; females larger and heavier. Longer, narrower bill of female appears to have drooping tip; male's bill shorter, broader. Mean length of bill (exposed culmen), flattened wing, tarsus, and bill length:depth ratio (depth measured at gonys) and mass of adult and hatching-year birds provided in Table 4. Tail length of 14 individuals in Juvenal plumage averaged 98 mm (Webster 1942).

PRIORITIES FOR FUTURE RESEARCH

Because few adults have been individually marked, little work has focused on the extent and distance of migration or the dispersal of young and adults from their breeding sites. Likewise,

robust survival estimates, for both breeding and prebreeding birds, are unavailable. Identification and protection of winter concentration areas could be important for conservation of the species. Large variations in breeding-pair density and patterns of territory establishment lead to intriguing questions regarding the relatedness of pairs nesting in close proximity. Little is known about pair dynamics, specifically about divorce rate and mate replacement in pairs.

No detailed studies on Black Oystercatcher vocalizations exist; data are needed on the ability of individuals to recognize mates and neighbors, on variation in calls among individuals, the sexes, and populations, and on seasonal variation in call function.

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Appendix. Percentages of numbers and biomass and average sizes (n) of prey taken by Black Oystercatchers in n.-central California and Prince William Sound, AK. tr = trace recorded in diet.

PREY SPECIES	California ¹ ($n = 6,214$)			Alaska ² ($n = 1,494$)		
	% no.	% mass	mean size ³	% no.	% mass	mean size
Sea Mussel	24.9	71.0	50.1 (151)	–	–	–
Bay Mussel	–	–	–	35.9	21.9	32.7 (1,727)
Horse Mussel	–	–	–	1.3	1.1	42.4 (155)
Clams	–	–	–	4.7	19.6	34.5 (558)
Limpets	37.6	8.0	14.9 (578)	48.7	37.3	21.0 (4,904)
Whelks	9.9	2.6	17.3 (70)	tr	tr	–
Other gastropods	16.7	4.3	–	tr	tr	–
Chitons	1.6	3.5	30.6 (23)	4.0	18.1	65.8 (188)
Isopods, crabs	1.1	0.5	–	tr	tr	–
Barnacles	–	–	–	5.2	1.4	–
Purple Urchin	1.3	5.8	39.5 (80)	–	–	–
Other species	6.9	3.3	–	0.2	0.5	–

¹Observations on foraging birds near Bodega Bay (Falxa 1992).

²Observations on prey delivered to chicks in Prince William Sound (BAA).

³Measured in mm across long axis of prey.

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ABOUT THE AUTHORS

Brad A. Andres is completing his Ph.D. study of the effects that the *Exxon Valdez* oil spill had on Black Oystercatchers breeding in Prince William Sound, AK. He conducted his M.Sc. research on migratory shorebirds on the North Slope of Alaska and is currently coordinating migratory landbird and shorebird programs and conducting field projects within Region 7 of the U.S. Fish and Wildlife Service. Current address: U.S. Fish and Wildlife Service, 1011 East Tudor, Anchorage, AK 99503.

Gary Falxa became captivated by oystercatchers as a graduate student, leading to research on Black Oystercatcher foraging behavior. He received a Ph.D. in zoology from the University of California, Davis, in 1992. His interests include avian ecology and behavior, tropical ecology, and conservation biology, and pursuit of those interests through field research and teaching. Gary is a native of California, where he now resides after years in foreign states and countries. He currently works on natural resource conservation issues and teaches a summer field course in conservation biology. Current address: U.S. Fish and Wildlife Service, 3310 El Camino, Suite 130, Sacramento, CA 95821.

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