

Order CHARADRIIFORMES

A large, diverse assemblage of small to medium-large (12–75 cm long) limicoline, pratincoline, aquatic or terrestrial birds. Cosmopolitan from Arctic to Antarctic regions; in all sorts of maritime, freshwater and open terrestrial habitats (including deserts) with a few (woodcocks and snipes) even using dense forests. Once known as Limicolae or Laro-limicolae (e.g. Mayr & Amadon 1951); colloquially, the assemblage (excluding alcids, skuas, gulls, terns and skimmers) is often referred to as waders (especially in Britain) or shorebirds (especially in North America).

About 350 species in 19 families, though taxonomic treatments vary. Following families recognized (mostly based on recent reviews of Order [Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990]):

Thinocoridae	seedsnipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painted snipes; two species, s. America and Old World.
Jacaniidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; c. 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratincoles, coursers, and Egyptian Plover; c. 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; c. 47 species, cosmopolitan.
Sternidae	terns; c. 42 species, cosmopolitan.
Alcidae	auks; c. 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA–DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA–DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacaniidae) and charadriids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidiorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to charadriids (e.g. Sibley & Ahlquist 1990). Further relationships within the Order discussed in introductions to families.

Because the Order comprises so many species and adaptations are so diverse, few characters shared by all species; those that are shared are mostly anatomical features of the skull, e.g. most or all have schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacaniidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

breeding and partial pre-breeding; some jacanas and alcids have flightless periods when moulting remiges. Young, downy, usually with intricate cryptic patterns on upperparts of three chief types: pebbly, spotted and striped, matching characters of habitat (Fjeldså 1976, 1977): precocial, nidifugous usually, self-feeding or not depending greatly on parents.

Thirteen families recorded in HANZAB region, with 54 species breeding, 41 occurring as regular non-breeding migrants and c. 38 as accidentals or probable accidentals. Scolopacidae, Stercorariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Family HAEMATOPODIDAE oystercatchers

Rather large (40–49 cm long) black or pied waders, heavily built, with sturdy legs, and long straight robust bills. About 21 species and subspecies, all in single genus *Haematopus*; almost worldwide on temperate and tropical coastlines. Species limits uncertain (Baker 1975, 1977); rather uniform structure and simple patterns of plumages not reflecting well any generic differentiation of allopatric species and subspecies; as few as three species and as many as twelve have been recognized. The relationships and arrangement of species or subspecies continues to be debated; we treat as five species in our region, two endemic to Aust. and three to NZ and Chatham Is. Probably most closely related to Recurvirostridae (q.v.); intermediate anatomically and behaviourally between Scolopacidae and Laridae.

Solidly built. Sexes similar; females slightly larger than males. Necks stout; 15 cervical vertebrae. Wings, long and pointed; 11 primaries (p11 minute), 18–20 secondaries and moderately large carpal knob. Tails, short and square; 12 rectrices. Bills, long and straight, laterally compressed; adapted for opening shells and chiselling molluscs off rocks, with muscles of jaw and neck strongly developed (Burton 1974). Bills range from blunt and square-tipped to pointed; length and shape of bill-tip varying in individuals according to choice of prey and feeding substrate (Hulscher & Ens 1991). Nostrils, pervious; schizorhinal. Legs, stout and rather long; tarsi, reticulated with small hexagonal scales. Toes, stout, only transversely scutellated on distal half; slightly webbed at base, no hallux. Caeca present. No crop. Large supraorbital glands.

Plumages, black or blackish brown, some species with white underparts, rump and wing-bars. Bills, legs and feet, orange or pink to red; irides, scarlet or yellow; orbital rings, reddish (yellow in *H. leucopodus*). Two moults per cycle. Post-breeding moult, complete, primaries outwards; pre-breeding moult, partial but only in Eurasian Oystercatcher *H. ostralegus* do breeding and non-breeding plumages differ markedly. Young hatch in soft woolly down; most species, brownish grey, with white belly and vent, all with dark lines and spots above forming simple pebbled pattern, similar to that of Burhinidae. Juveniles, duller scalloped versions of adult with darker bare parts; first breed at about 3–5 years. Stand erect or with neck hunched and bill pointing down. Flight, direct and fast with rather shallow wing-beats.

Typically of coastlines, especially in rocky areas, though many also use sandy beaches or mudflats. Eurasian *H. ostralegus* and South American *H. leucopodus* Oystercatchers also have inland breeding distribution and, in NZ, *H. finschi* breeds chiefly on braided rivers or nearby farmland; even these chiefly coastal in non-breeding period. Most species sedentary or with only local movements during non-breeding period; some populations of Eurasian Oystercatchers *H. ostralegus* strongly migratory. Many oystercatchers specialize in feeding mostly on molluscs and crustaceans, including hard-shelled barnacles, chitons, limpets and pelecypods, which few other birds can attack. Considerable strength and skill required to open such prey; feeding techniques vary with type of prey and may take a long time to become proficient. Other invertebrate prey taken, especially when feeding on mudflats or farmland, including polychaete and oligochaete worms, and insects.

Breed solitarily, spaced out in defended territories. In non-breeding season, form small groups to large flocks (more so in black-and-white species), though resident pairs may stay on territories with local movements of subadult and non-breeding birds. Monogamous; pair-bonds in those species studied usually life-long, with divorce rare. Courtship, territorial and distraction displays well-developed. Both sexes incubate and attend the young. Most conspicuous vocalizations of all species are loud piping calls in display and alarm.

Breed seasonally. Nests, simple scrapes crudely lined with any suitable material near at hand. Eggs, rounded oval, buffish to whitish and fairly glossy, with varying but heavy blotches, spots and streaks of black-brown. Clutch-size, 2–4. Incubation period, 25–28 days. Young hatch in down; precocial, nidifugous; can run as soon as down is dry and can swim and dive at need. Young fed by adults and fledge at about 5 weeks.

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Haematopus chathamensis Chatham Island Oystercatcher

COLOUR PLATE FACING PAGE 713

Haematopus ostralegus chathamensis Hartert, 1927, *Nov. Zool.* 34: 17 — Chatham Islands.

Specifically referring to the islands where the bird is endemic.

MONOTYPIC

FIELD IDENTIFICATION Length: 47–49 cm; weight: 560–640 g. Large, sturdy black-and-white oystercatcher, restricted to Chatham Is, with long reddish bill and rather short stout pinkish legs and feet. Slightly smaller than Variable Oystercatcher *Haematopus unicolor*. Sexes similar, separable when pair together: female slightly larger with longer bill. No seasonal variation. Juvenile and immature separable.

Description Adult At rest, head, neck, breast and upperparts, glossy black; rest of underbody, white, except for tuft of blackish feathering on rear of tibia. Black smudging along line of demarcation between breast and belly, sometimes only on sides of breast, where it may be covered by carpal, and demarcation can

then appear sharp. Area of white between black breast and folded wing varies with posture; usually large and prominent, with little black smudging but sometimes showing only as small white patch above carpal. In flight, upperparts mostly black, with bold even white wing-bar, from trailing-edge of inner secondaries across bases of secondaries and tips of greater coverts; white of upper tail-coverts and rump ends squarely on lower back and partly obscured by some black smudging. Underwing: secondary coverts, mostly white, with black leading-edge and dusky smudging toward body; greater primary coverts, blackish; other primary coverts, blotched dark brown and white; remiges, glossy grey-black, slightly paler on bases. Bill, bright orange, with paler yellowish tip in some. Iris,

scarlet. Orbital ring, orange-red. Legs and feet, coral-pink. **Juvenile, Immature** Differ from adult in same way as described for pied-morph Variable Oystercatcher.

Similar species Only resident oystercatcher on Chatham Is. **South Island Pied Oystercatcher** *H. finschi* has occurred there, and differs by: clean white upper tail-coverts and rump, with white extending as sharp wedge onto upper back; sharp demarcation between black breast and white underparts, with line of demarcation slightly higher on breast; wing-bar slightly broader; more white on underwing, with clean white coverts and white bases to remiges; slightly smaller and slimmer, with longer bill, and less heavy legs and feet; prefer sandy beaches and mudflats, and less likely to be seen on rocky shores, which are preferred by Chatham Island Oystercatcher. Very similar to pied-morph **Variable Oystercatcher**, which has not been recorded on Chatham Is and which differs by: usually lacking shoulder tab or has only trace of one, always heavily obscured by black mottling. Slightly less pied forms of Variable Oystercatchers readily distinguished by more black mottling on lower back, rump, upper tail-coverts and underparts, and by narrower and shorter wing-bar; further, slightly larger size, noticeably longer and more deeply based bill, and less heavy legs and feet of Variable Oystercatcher may be noticeable in direct comparison.

Inhabit rocky tidal platforms and short shoreline vegetation; rarely, on sandy beaches. Habits similar to those of Variable Oystercatcher. Forage in typical oystercatcher manner, probing at low tide among beds of mussels and limpets and in tide-wrack and shoreline vegetation. Gait deliberate, similar to that of Variable Oystercatcher but heavier and more hurried. Seldom fly. Strongly territorial throughout year; usually seen in pairs, rarely in groups of more than family size but occasionally up to nine seen together. Voice like that of Variable Oystercatcher.

HABITAT Coasts of oceanic islands in Chatham Grp. Mainly along rocky shores, including wide volcanic rock-platforms; occasionally on sandy or gravelly beaches. Forage in wide range of habitats: mainly in littoral zone of rocky coasts, usually at low water on volcanic platforms, either exposed or in shallow water; also on beaches composed of sand, gravel, shingle or boulders (Fleming 1939; Baker 1973, 1974a; Davis 1988).

Breed on rocky, sandy or shelly shores, sometimes in short vegetation or saltmarsh or on shingle or among boulders, on edges of cliffs or in small caves (NZRD). During gales, shelter in less exposed areas (Baker 1974a).

DISTRIBUTION AND POPULATION Endemic to Chatham Grp. Widespread throughout, on Mangere, South East, Pitt and Chatham Is (Fleming 1939; Baker 1973; NZCL); unconfirmed report of seven on Star Keys, 1987–88 (Davis 1988). Breed on all islands (CSN 26).

Considered endangered (IUCN 1979). Survey during summer 1987–88 recorded 100–110 birds; of 44 pairs recorded, 25 on Chatham I., nine on Pitt I., eight on South East, and two on Mangere (possibly one pair on Star Keys); in autumn 1990, on Mangere I., five adults and single juvenile (CSN 38); in 1987–88, total population density, 0.13 pairs/km: Chatham I., 0.1 pairs/km; Pitt I., 0.16 pairs/km; South East, 1.05 pairs/km; Mangere, 0.28 pairs/km (Davis 1988). Earlier population estimate, based on survey in 1970–71, c. 50 birds (Baker 1973; IUCN 1979; NZCL). Populations thought to have been rather constant over past century (Baker 1973; NZCL) now possibly declining (A.M.Davis). Numbers on n. Chatham I. thought to have increased recently (B. Tuanui; K. Kamo); on South East, numbers declined from 13 pairs in 1977–78 to eight pairs in 1987–88 (Davis 1988).

MOVEMENTS Generally sedentary but movements between islands recorded (all distances refer to shortest distance between islands) (Baker 1973). Most pairs maintain territory throughout year and limit activities to discrete area; three pairs recorded breeding on South East I. and regularly feeding on Pitt I., c. 2 km away. Unpaired birds move between islands during breeding season. Juveniles from South East I. disperse mainly to Pitt I. (some at both in one season) but also to Mangere I. (c. 11 km) and Chatham I. (c. 40 km). Movement of juvenile or other unpaired birds from Chatham I. to Pitt I. (c. 25 km) yet to be recorded (Davis 1988).

FOOD Nemertean, polychaetes, molluscs, crustaceans, echinoderms, ascidians, anemones and, rarely, small fish. **Behaviour** Diurnal and nocturnal, especially on moonlit nights. Forage almost exclusively on tidal platforms, mainly at low tide when sublittoral zone exposed. Feeding methods recorded: (1) nemertean taken by probing into wet sand to a depth of one-quarter to three-quarters of length of bill; success rate, only c. 25%; (2) amphipods, and ribbon worms taken by shallow probing in algal turf; sandhoppers taken with shallow probing into sand and round debris (Davis 1988); (3) bivalves: if partly open, thrust bill deep into gap between valves using minimum dimension of (bill <1 mm wide at tip), then exerting downward pressure



against substrate, rotating bill and head through 90°, usually to left (91.7%, $n=24$), so that 9–12 mm depth of bill forces adductor muscles to snap or seriously weaken, so shell can then be opened; (4) limpets: weaken grip by sharp vertical blows when limpets freshly exposed and show a small gap between shell and substrate, then push or lever with bill till dislodged; (5) chitons: removed from rocks by a sharp angled blow to shell-plates; if this not effective, apply sideways pressure to margin of foot until small area detached; then place bill under chiton, flat side against rock, and cut from rock using scissor-like movements of bill; remove flesh by inverting shell in crevice and paring flesh with scissor-like movements of bill; sometimes removed in one piece and swallowed whole (Baker 1974a; Davis 1988). Wade to top of tarsus and peck through water. Will carry food some distance to avoid interspecific competitor, such as Weka *Gallirallus australis* (Davis 1988).

Adult Animals (observations and suggested prey) (Baker 1974a; Davis 1988): Cnidarians: anemones: *Isactina tenebrosa*. Nemerterans. Annelids: polychaetes. Molluscs: polyplacophorans: *Chiton pelliserpentis*; *C. glaucus*; gastropods: small gastropods; *Haliotis australis*; *H. iris*; Patelloidea: limpets (<4 cm); *Cellana strigilis chathamensis*; *Patelloidea corticata corticata*; *Zediloma digna*; *Littorina oliveri*; *Zeacumantus pulex*; *Buccinulum multilineum*; *Cominella maculosa*; *Haustrum haustorum*; bivalves; Mytilidae: mussels: *Aulacomya ater maoriana*; Blue Mussel *Mytilus edulis aoteanus*; *Xenostrobus pulex*. Crustaceans: barnacles: *Chaemaesipho brunnea*; *Lepas anatifera*; amphipods: *Talorchestia maorianus*. Echinoderms: echinoids: *Evechinus chloroticus*. Ascidians: *Pyura pachydermatina*. Fish.

Young Fed by parents. No other data. **Intake** No data.

SOCIAL ORGANIZATION Major study of entire population by Davis (1988). Generally in pairs, which defend territories all year but most vigorously during breeding season. In non-breeding season, some pairs move into nearby areas, often joining other pairs and single birds.

Bonds Long-term monogamy, with high fidelity to mate and site; two pairs known to have remained together in same area for more than 10 years. No known separation of pairs. Some birds pair and establish territories in first year, but first pairing may occur as late as 6 years old; do not breed until 3 years old; first pairing at later age may indicate lack of habitat to establish territory or lack of available space to join already established bird. Not all pairs breed every year, e.g. in one year 52% ($n=44$ pairs) bred, 27% did not, and 21% unconfirmed; some pairs contained sexually immature birds, but others consisted of confirmed past breeders. Begin territorial flight and courtship displays early Oct., nesting begins within 8 weeks and may continue until Mar. **Parental care** Both sexes incubate, but female for longer; both involved in brooding, guarding, and feeding young. After fledging (47 days) and before dispersal, many juveniles remain with parents; probably most remain until end of present breeding season, but some until next breeding season.

Breeding dispersion Solitary. Nest-site density: 0.1–1.05 nests/km. Nests concentrated in suitable habitat; juvenile pairs may be attracted to these areas. **Territories** Pair defends area of coast all year but more so in breeding season. Only observed to change territory when mate lost. If nest lost, some pairs still have vigorous territorial disputes with neighbours and single birds, but others very quiet, roosting and feeding in territories. Single birds, often juveniles or young birds, sometimes defend territories; have much larger home-range, sometimes moving between islands. Territories usually discontinuous, related to distribution of volcanic rock-platforms (preferred habitat). Territories of all paired

birds included volcanic rock-platform, whereas single birds more commonly on sandy beaches or narrow rock-platforms; mean length of 0.56 km (0.2–0.76; 44 pairs) of coastline, and mean width of 0.1 km, with mean size of 0.056 km². Territories usually discrete and used for all activities: feeding, roosting and displaying, though some pairs hold additional feeding territories that they defend against conspecifics.

Roosting Within territory. Pairs roost together after courtship displays. During day more time spent roosting and preening than on feeding. Mostly feed at low tides, even at night, particularly when moonlit.

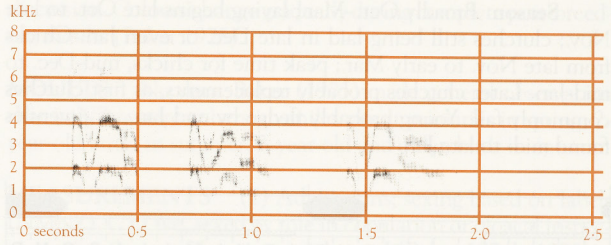
SOCIAL BEHAVIOUR Major study of entire population by Davis (1988). Sensitive to disturbance by people, particularly when nesting. Behaviour similar to other oystercatchers (Davis 1988); courtship displays similar to those described for South Island Pied Oystercatcher and Variable Oystercatcher (Baker 1974c).

Agonistic behaviour Territory established or re-established by frequent aerial displays. In one aerial display, both members of pair perform zigzag flight while giving shrill calls; members of pair often bump into each other. When nesting, disputes frequent and intense, but intensity varies between pairs. Territorial behaviour and accompanying calls, in order of increasing intensity include: (1) Alert Posture and loud calling; (2) Alert Posture, with Head-bobbing, and Body-rocking; (3) Alert Posture, with Lunging, short Ground Chases, some loud calling and squawking; (4) Aerial Chases, lunging in mid-air and loud calling; (5) Piping Display, which occurs when intruders flying overhead or on ground, especially at territorial boundary; display includes Head-bobbing, Body-rocking, Alert Posture with birds facing each other, Parallel Walking and feeding of pairs, Displacement Pecking, lunging at intruder, and PIPING POSTURE, where body flattened and held stiffly, with bill pointing to ground; loud calling common throughout Piping Display and with Piping Posture continuous Piping Call given. Social Piping described for all NZ oystercatchers (Baker 1974c; see South Island Pied Oystercatcher), but no details of function given for this species. When intruder flying overhead, usually only Piping Display and call given. When intruder on ground, all, or some, of above behaviours shown. Piping Displays particularly intense when neighbouring pairs dispute territorial boundary. **Alarm** Usually react to potential predators by scanning area rapidly, calling loudly, and sometimes taking off in short flight. Foraging birds will actively avoid predators, e.g. carry food away from shore when predators near.

Sexual behaviour **Courtship** Ritualized. Behaviour includes (in early breeding season, some displays appeared to be directed at observer): (1) PICK-AND-TOSS DISPLAY, where birds of pair stand within a few metres of each other picking up pieces of debris, such as tussock twigs, dried algae, and flicking to one side; continues for up to 10 min or occurs sporadically with birds roosting or preening between times; sometimes only one bird of pair performs while other stands watching. Often associated with SCRAPING DISPLAY where either bird of pair sits down with breast pushed into ground, kicks legs out from behind two or three times, and gives Squeaky Call; partner stands several metres away watching; sometimes pair display alternately. After this display, pair usually preens, then roosts together. (2) AGGRESSIVE DISPLAY within pair seen once; birds stood facing each other with their breasts puffed out for up to 20 s then moved off to feed or roost. (3) One of pair stationary in crouched posture with upraised wings while partner, also in crouched posture, runs towards mate; both birds give Piping Call; display often precedes copulation. (4) DISPLACEMENT PECKING and FALSE-BROODING observed on a few

occasions before nest-building. Social Piping said to be used in pair-formation in all NZ oystercatchers (Baker 1974c) though he also stated that courtship behaviour and pair-formation of Chatham Island Oystercatcher was unknown. **Greeting** During incubation, change-over usually prompted by sitting bird flying or walking off nest, giving shrill call, and partner usually responding by walking slowly to nest. **Copulation** Before copulation, one pair seen to do Aggressive and Pick-and-toss Displays (Davis 1988). **PRE-COPULATORY POSTURE** described, where male approaches female with head drawn between shoulders and held to one side of body, which is generally lowered and tail depressed and fanned. Occasionally male simply walked to female and mounted or flew onto her back from a short distance. Responsive female raises body higher above ground than normal and erects tail feathers above horizontal (Baker 1974c). Male mounts from behind and, during coition, flaps wings (Baker 1974c). Of four copulations, mount time brief, c. <10 s; no post-copulatory displays seen (Davis 1988).

Relations within family group During incubation, non-sitting bird sometimes stands guard 5–10 m away. Some pairs leave nests unattended for 15–20 min or up to 1 h. After chicks dry, led off nest. Young remaining on territory until after breeding season, displaced by parents. **Anti-predator behaviour of young** When <1 week old have not learnt to hide from intruders; often become separated from parents, and despite rather high mobility and cryptic plumage, easily taken by predators. Older chicks learn to hide, and difficult to detect because of cryptic plumage. **Parental anti-predator strategies** When nests approached by potential predators or people, birds seldom fly; give range of Distraction Displays, often accompanied by shrill calling and agitated movement, including: running forward in front of intruder in hunched profile, calling quietly and sometimes stopping to squat on ground, False-brooding; moving quietly off nest then squatting or standing behind rock or log, facing away from intruder but peering back; flying off nest and up into the air to circle about territory, while calling loudly. Incubating bird moves off nest well before intruder reaches territory, and does not return until intruder well out of sight. When with young, behaviour more intense; when intruder first sighted, adults give loud Alarm Call, warning chicks to hide; once intruder within 20 m of young, adults fly at intruder giving shrill call; also run about in agitated manner, continuing to give shrill calls, as they attempt to draw intruder away from



B P.J. Fullagar; South East I., Chatham Is, Jan. 1974; X039

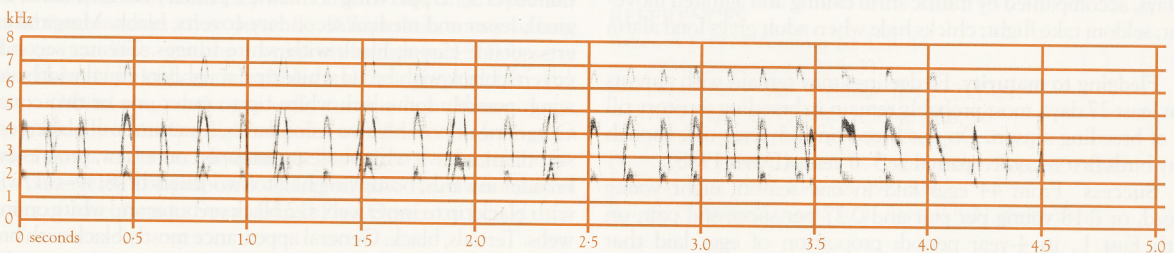
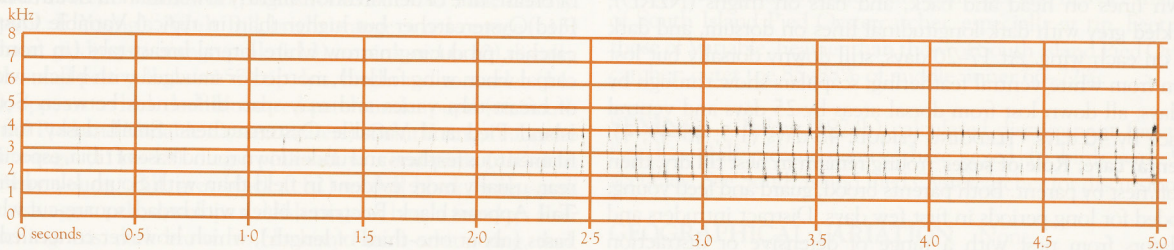
young. Observed performing defensive or distraction displays in presence of Swamp Harriers *Circus approximans*, Kelp Gulls *Larus dominicanus*, skuas and people; do not display in presence of Silver Gulls *L. novaehollandiae* or Wekas *Gallirallus australis*. Successful in driving away Kelp Gulls and skuas.

VOICE Reasonably well known from study of Baker (1974c), which includes sonagrams; some information in Davis (1988). Calls are loud piping in courtship and aggression, piercing alarm call and quiet flight call. Calls resemble those of South Island Pied Oystercatcher, and Piping Call similar in pitch. Piping Call of Variable Oystercatcher similar in structure but of lower pitch (Baker 1974c).

Adult PIPING CALL (social and aggressive): starts with sharp *pic* notes, gathering quickly into prolonged chorus of highly pitched calls *kervee-kervee-kervee...*, and ending in a short lower trilling phrase (sonagram A, which shows call with no trilling phrase). Male and female call simultaneously, often in unison; may stimulate other Oystercatchers to call. Also associated with aggressive displays. **ALARM CALL**: piercing *hu-eep* (A.J. Baker); sonagram B shows this call, made during a distraction display. **FLIGHT CALL**: quiet *kleep* (A.J. Baker). **SQUAWKING**: given during territorial disputes; not described (Davis 1988). **SHRILL CALLS**: given during zigzag flight of pair in aerial display; also when leaving nest at change-over; not described (Davis 1988).

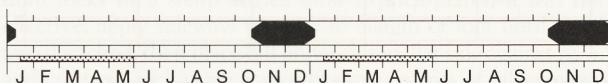
Young No information.

BREEDING Virtually unknown. All information from Baker (1974c), CSN 29 and review of research and conservation work by Davis (1988).



A L. McPherson; South East I., Chatham Is, Dec. 1971; P104

Season Broadly Oct.–Mar.; laying begins late Oct. to late Nov.; clutches still being laid in late Dec. or even Jan. Chicks from late Nov. to early Mar.; peak time for chicks, mid-Dec. to mid-Jan. Later clutches probably replacements, as first clutches commonly fail. Young probably fledge by end Jan., as juveniles found mid- to late Jan.



Site Away from waterline, in sheltered area higher up on shore or among short vegetation *Disphyma*, at base of small shrubs; on rocky shores, sand or boulder beaches, in small caves, under large boulders, on edges of cliffs. For 19 nests: 32% on sandy beaches, 5% on boulder beaches; on rock platforms, 21% open to sky, 5% under overhanging rock; on cliff-ledge, 11% open to sky, 11% under overhanging rock; in vegetation on margin of shore, 11% open to sky, 5% under overhanging vegetation. High fidelity to site.

Nest, Materials Scrape on ground, unlined (32%) or lined with dead vegetation (42%), shingle (21%), shell (11%) or dung/kelp (5%); some nests ($n=19$) contain more than one type of lining.

Eggs Olive-grey with fine dark brown spots and waves. MEASUREMENTS: $56.0 \pm 0.47 \times 40.6 \pm 0.16$ (A. Davis), $57.0 \pm 0.81 \times 39.6 \pm 0.32$ (E. Young), $56.9 (2.20; 21) \times 40.5 (1.19)$ (Baker 1974c). WEIGHT: 46.0 (1.77; 16) (Baker 1974c). VOLUME: 46.1 ± 0.57 (A.M. Davis), 46.8 ± 1.96 (E. Young).

Clutch-size Early clutches contain three eggs, later ones two eggs; higher proportion of three-egg clutches in n. part of islands.

Laying Interval, 48 h. Will re-lay after failure, after a minimum of 3 weeks in most pairs. Do not re-nest after successfully fledging young.

Incubation By both sexes, female tends to incubate for longer intervals, and for most of time (Davis 1988); in stints of about 75 min (NZRD). May leave nest unattended for 15–20 min. INCUBATION PERIOD: for three pairs, 25.1 ± 1.2 days. Hatching asynchronous, taking 48–72 h; in two-egg clutches, eggs hatched 12 h apart.

Young Precocial. Nestlings have buff-grey down, with dark-brown lines on head and back, and bars on thighs (NZRD); speckled grey with dark longitudinal lines on dorsum, and dark line on each wing. At 17–20 days, still downy dorsally but lost down from white ventral feathering; scapulars show through by 20 days; all down lost from dorsal areas by 25 days and ventral surface by 40 days. FLEDGING PERIOD: 48 days (1.5; 46–49; 4).

Parental care, Role of sexes Young remain in nest till dry, then led off nest by parent. Both parents brood, guard and feed young; brooded for long periods in first few days. Distract intruders and predators from nest with a range of defensive or distraction displays, accompanied by frantic shrill calling and agitated movement; seldom take flight; chicks hide when adult gives loud alarm call.

Fledging to maturity Fledgelings may remain with parents for at least 27 days, most probably remain in breeding territory till end of breeding season. Do not breed until 3 years old, though many birds first recorded paired at 5–6 years (Davis 1988).

Success From 44 eggs laid in one season, eight young fledged, or 0.18 young per pair and 0.27 per successful pair; on South East I., in 4-year period: proportion of eggs laid that hatched ranged from 32% to 68%; proportion of eggs that fledged young, 11% to 26%; eggs hatched that fledged young, 25% to

60%. Annual productivity over 12 years, 0.47 young per pair (0.05; 0.2–0.85). Percentage of second clutches producing young ranged from 16% to 60%. Eggs taken by skuas (A.M. Davis). Mean longevity, from 28 colour-banded birds: 7.7 years, though likely to be higher as about half birds banded were adults; oldest birds at least 19 years; estimated mortality of rate of fledged chicks to adult age, 63%; annual juvenile mortality, assuming survival of subadults and adults similar, 52%; mortality of chicks for 3-year period on South East I., 32%.

PLUMAGES Prepared by D.J. James. Hatch in natal down. Begin pre-juvenile moult at unknown age. Partial post-juvenile moult introduces first immature plumage, followed by partial pre-breeding moult introducing second immature, latter without changing appearance. Thereafter, complete post-breeding and partial pre-breeding moults each cycle produce alternating non-breeding and breeding plumages without seasonal variation in appearance. Sexes similar. Age at first breeding, third to sixth year (Davis 1988 cf. Baker 1974b).

Adult (Definitive basic and alternate). Only two skins (NMNZ) and photos examined. Underdown, and plumulaceous bases to feathers, sooty grey (c84 or 91) in zones of black feathering and white in zones of white feathering. **Head and neck** Entirely black; greenish gloss when fresh, rapidly lost with wear, plumage becoming blackish brown (brown 119). **Upperparts** Mantle, scapulars and back, black, as head; rump and upper tail-coverts, white. Straight, fairly sharp and clean demarcation between black back and white rump; usually two or three rows of feathers that are partly black and white. Line of demarcation is on lower back, similar to pied-morph Variable Oystercatcher; line of demarcation is below overlying scapulars and, in flying bird, always visible, appearing to end in straight line across back unlike South Island Pied Oystercatcher, which appears to form white wedge on upper back. Longest upper tail-coverts, black to black-brown (119) with white bases, concealed by white coverts of overlying row. Tuft of bristly feathers and down round pygostyle, brown (c28) (which may be staining), normally concealed by tail-coverts. **Underparts** Upper breast, black; lower breast, white; demarcation, straight and sharp, typically intermediate between that of South Island Pied and Variable Oystercatchers; usually a few black smudges on centre of breast (white feathers with black tips) below line of demarcation and more dark smudging at sides of breast; line of demarcation slightly lower than in South Island Pied Oystercatcher but higher than in typical Variable Oystercatcher, producing narrow white lateral breast-tabs (in front of carpal when wing folded), mottled or smudged with black; width of breast-tabs varies and may span differences between South Island Pied and Variable Oystercatchers. Small dusky tuft of filamentous feathers and underdown round base of tibia, especially rear, usually more evident in field than with South Island Pied. **Tail** Appears black. Rectrices, black with broad, square-cut white bases (about one-third of length), which however concealed by tail-coverts. **Upperwing** Primaries, primary coverts, alula, marginal, lesser and median secondary coverts, black. Marginal coverts outside carpal, black with white fringes. Greater secondary coverts, black with broad white tips, roughly of equal width along wing; possibly some lack white tip to outer one or two coverts. Outer one or possibly two secondaries, sometimes all black; rest of secondaries have white bases, narrow on outer few, progressively broader inwards, occupying half to two-thirds of s8; s9–s11, white with black tip to inner web; s12 black on outer and white on inner webs. Tertiaries, black. General appearance mostly black with broad white wing-bar, widest on inner secondaries, reaching trailing-edge of wing, and tapering outwards to outermost secondary;

similar to, but narrower, than that of South Island Pied Oystercatcher. **Underwing** Remiges, glossy grey-black (c82) or dark grey-brown with no or very little white showing on inner secondaries; primaries slightly paler at bases than tips; one skin had a little white speckling at bases of primaries. Leading rows of lesser secondary coverts, black, forming narrow black leading-edge to innerwing; other secondary coverts, white, sometimes lightly mottled with black near body on lesser and median coverts. Lesser and median primary coverts, blotched or mottled dark brown and white; feathers, dark brown (121) with white tips. Greater primary coverts, blackish brown with whitish bases. Subhumeral, white with dark-brown (119A) to blackish speckling or smudging at tips of some feathers, producing light mottling at base of wing. Some variation in pattern of underwing evident but how much, not known.

Downy young From photos (DOC Slide Library; unpubl.: E. Young) and single spirit specimen (NMNZ). Down, dense, woolly above; longer and thinner below. Crown and forehead, brownish grey (c79), finely and heavily speckled black. Short black mid-crown stripe, reduced, sometimes absent. Nape, hindneck and upperparts, grey with black speckling, which forms fine black broken bars. Indistinct black vertebral and paravertebral stripes, shorter than in other NZ oystercatchers. Irregular black dorso-lateral stripe behind wing. Side of head, grey, speckled and blotched black; fine black stripe from bill through eye. Throat, foreneck and upper breast, like sides of head but ground-colour darker (dark grey, c83). Rest of underparts, white. Tail, black at base of down, with broad white subterminal band and narrow dark tips. Trace of richer light-brown colour to down on dorsal surface of wing.

Juvenile No material examined. Probably similar to adult but with thin speckled light-brown fringes to feathers of upperparts, wing coverts and upper breast. Tertials and subscapulars appear to have more prominent pale blotches round fringes of feathers. Primaries more pointed than those of adults.

Immature (First basic and alternate). Like adult, except retain juvenile remiges and rectrices; tertials and subscapulars (probably sometimes retained in first basic but usually replaced in first alternate) can show traces of juvenile fringes. May show contrast between admixed worn dark-brown and fresh black feathers; worn primaries contrast with fresher body.

BARE PARTS Based on photos (NZRD; DOC Slide Library; unpubl.: E. Young). **Adult** Bill, bright orange or red-orange (c15) at base, grading to orange-pink (c13) or pink-red (c10) distally, with small pale yellow (c157) tip. Iris, bright red to scarlet (14–12); appears to lack dark blood-red patch under pupil (cf. South Island Pied and Variable Oystercatchers). Orbital ring, orange to red-orange (c116–15). Legs, pink-red to coral-pink (c10–13). **Downy young** Bill, grey-black (c82) to dull black, with small whitish egg-tooth; develops reddish tinge at base a few days after hatching. Iris, dark brown to blackish. Small orbital ring, dark grey, inconspicuous. Legs, grey with olive to buff tinge especially behind tarsus and on soles. **Juvenile** Bill, pinkish orange at base of lower mandible, grading to pinkish-brown (c219D) base of upper and middle of both mandibles and dark grey tip. Iris, dark brown. Orbital ring, dark, gradually turning light brown. Legs, grey, gradually becoming lighter; paler with buff or pink tinge on hind of tarsus and soles. **Immature** No material examined.

Baker (1974b) proposed ageing scheme based on study of colours of bare parts in South Island Pied Oystercatcher; q.v. for

discussion. Colours change gradually during complete post-breeding moults (Baker 1975).

MOULTS No data. Baker (1975) made general observation that in NZ oystercatchers juveniles moult primaries in spring; 2-year-old birds, in summer; 3-year-old and older, birds in autumn.

MEASUREMENTS (1) Adult, skins; sexing based on labels (NMNZ). (2) Live; sexed by role in copulation or cloacal inspection; wing flattened but not straightened (Baker 1974b, 1975).

	MALES	FEMALES	
WING	(1) (2) 251 (6.2; 8)	260, 264 266 (8.5; 8)	**
TAIL	(1) (2) 96 (2.8; 8)	96, 102 99 (3.1; 8)	*
BILL F	(1) (2) 67.8 (2.7; 8)	74.5, 80.8 76.8 (5.6; 8)	**
BILL D	(2) 16.2 (0.4; 8)	16.9 (0.6; 8)	
BILL W	(2) 13.1 (0.3; 8)	14.1 (0.8; 8)	**
TARSUS	(1) (2) 51.3 (1.3; 8)	52.7, 54.7 53.7 (2.2; 8)	
TOE	(2) 34.9 (1.1; 8)	36.7 (1.3; 8)	**

Sexual dimorphism greater than in other oystercatchers in HANZAB region. Baker (1975) reported differences in depth of bill and length of tarsus to be significant in these samples, but this seems to be an error.

WEIGHTS Live adults at nest, sexed by behaviour during and role in copulation; weighed on spring balance accurate to 5 g: eight males average 560; eight females 640 (Baker 1975).

STRUCTURE From two skins (NMNZ). Very similar to South Island Pied Oystercatcher. P10 longest; p9 3–6 mm shorter, p8 12, p7 24–26, p6 40, p5 58–59, p4 73–75, p3 90–91, p2 103–104, p1 115–118, p11 minute. Orbital ring of adults, possibly thicker, like Variable; details of change with season lacking. Bill, long, heavy and straight; shorter than other oystercatchers in NZ (possibly in part because of wear from feeding entirely on rocky substrates); slightly laterally compressed at base; strongly laterally compressed and usually blunt at tip; deeper and heavier than bill of South Island Pied Oystercatcher, especially at tip. Feet, like those of Variable, heavier than those of South Island Pied Oystercatcher; outer toe 85–88% of middle, inner 66–72%.

SEXING Baker (1974b) calculated discriminant functions based on bill measurements; these sexed 16 birds with 94% accuracy. See South Island Pied Oystercatcher for discussion.

GEOGRAPHICAL VARIATION None.

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Volume 2, Plate 56 [scientific names added cf. original]

Variable Oystercatcher *Haematopus unicolor* (page 748)

1 Adult, pied morph; 2 Adult, intermediate; 3 Adult, black morph; 4 Downy young, pied morph; 5 Downy young, black morph; 6 Juvenile, pied morph;
7 Juvenile, black morph; 8, 9 Adult, pied morph; 10 Adult, black morph

South Island Pied Oystercatcher *Haematopus finschi* (page 727)

11 Adult, 12 Downy young; 13 Juvenile; 14, 15 Adult

Chatham Island Oystercatcher *Haematopus chathamensis* (page 734)

16 Adult; 17 Downy young; 18, 19 Adult