Overview of the life history, current status and trends of killer whale populations in coastal waters of the Northeastern Pacific

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Killer whales: global overview

- single species recognized, *Orcinus orca*
- may be multiple spp.; best described as a species complex
- cosmopolitan; most widely distributed non-human mammal
- highest densities in temperate or subarctic regions
- apex marine predator (non-human)
Ecological specialization in killer whales

- As a species, killer whales are generalists with > 150 prey species
- At the population level, diet and foraging behaviour highly specialized
- Foraging specializations represent fixed behavioural traditions
Killer Whales in coastal NE Pacific

- Important in First Nations’ mythology and art, held in high esteem
- Little or no pre-historic exploitation

Whale memorial, Old Kasaan, 1898

Totem pole, Alert Bay, 1978
Killer Whales in coastal NE Pacific

- Attitudes changed with arrival of Europeans
- West coast ‘blackfish’ considered a nuisance or dangerous menace and threat to livelihood
- Directed shootings may have been significant source of mortality
- Extent of possible depletion unknown
Killer Whales in coastal NE Pacific

- Live-capture fishery for aquaria, 1962-1976
- Total of 68 individuals taken, mostly off S Vancouver Island and Puget Sound
- Fishery highly selective for physically immature animals
- No information on population abundance, productivity
Beginning of scientific studies: 1971 onwards

- Management of live capture fishery required science advice
- Michael Bigg at Pacific Biological Station tasked with obtaining information on abundance, distribution, life history, etc
Innovation of photo-ID technique

- Bigg demonstrated that all individuals identifiable from photos of natural markings
- Photo-ID became primary field technique in 1973, and annual studies in Pacific Northwest have continued since
Killer whale ecotypes in northeastern Pacific

**Residents**: salmon specialists

- stable social structure
- travel in moderate to large groups
- seasonal movements related to salmon
- do not hunt mammals

**Transients**: mammal specialists

- dynamic social structure
- travel in small groups
- year-round presence in inshore waters
- do not feed on fish

**Offshores**: shark specialists?

- travel in large groups
- wide ranging seasonal movements
- feed on deep-water and surface sharks, and some teleost fishes
‘Resident’ killer whales

B Gisborne
Resident killer whale populations in coastal NE Pacific

- Northern (264)
- W Gulf of AK/Eastern Aleutian/Bering Sea shelf (> 1000)
- Southern (87)
Resident killer whales: features in common

- Populations mostly allopatric, overlap at range limits
- Populations maintain social and reproductive isolation even in sympatry
- Highly stable matrilineal social structure
- Have learned vocal dialects that reflect matrilineal ancestry
- Ecologically specialized: fishes, particularly salmon, squid
Matrilineal social structure
Population dynamics of resident killer whales

• Stable group structure allows detailed demographic analyses
• Since 1973, 665 SR and NR whales identified and monitored; 351 alive today
• 85% of current SR and NR observed since birth
Life history parameters: Females
(during period of unrestrained growth 1974-96)

- Mean life expectancy: 46 years
- Maximum longevity: ≅ 80 years
- First viable calf: average 14.1 years (range = 10-21 years)
- Gestation period: 16-17 months
- Calving period: diffusely seasonal, most in fall/winter
- Calving interval: typical 3 years, avg 4.9 years (range = 2-11 years)
- Calf production: avg 4.7 calves over 24 year reproductive lifespan
- Repro. senescence: 50% senescent at 38 years; 100% at 46 years

Life history parameters: Males
(during period of unrestrained growth 1974-96)

• Mean life expectancy: 31 years
• Maximum longevity: ≅ 60-70 years
• Sexual maturity: average 13.0 years (range = 9-18 years)
• Physical maturity: average 18.5 years


Growth of northern resident male A13

Born Sprouter Mature Old
Abundance trends in Southern & Northern Residents

Sources: NRKW - Ellis, Towers & Ford 2011 DFO Tech Rep 2942
SRKW - Center for Whale Research, Friday Hbr, WA
Back-projected trends in Southern & Northern Residents

- Demographic modeling suggest both populations were increasing in late 1950s to early 1960s
- Cropping during 1960s & early 1970s removed:
  - NR: 15 (8 M, 7 F)
  - SR: 35 (23 M, 12 F)
- Recovery of SR likely hindered in 1970s & 80s by altered demographics

Sources: Olesiuk et al. 1990. IWC Spec. Issue 12
Abundance trends in N Gulf of Alaska residents

Distribution of Northern & Southern Residents

Northern
(n = 4,765 encounters)

Southern
(n = 12,956 encounters)

Sources: Ford 2006 CSAS Res Doc 2006/072; Whale Museum, Friday Hbr; L. Barre, NOAA
Critical Habitats designated under SARA and ESA

- Based primarily on summer occurrence
- Winter distribution poorly understood

Northern resident

Southern resident

Sources: Ford 2006 CSAS Res Doc 2006/072
Acoustic monitoring: Swiftsure Bank

- Frequent year-round use suggests potential critical habitat for both Southern & Northern residents

Source: Riera, Ford & Chapman. in prep.
‘Transient’ (or Bigg’s) killer whales
Approximate ranges and sizes of transient populations in the NE Pacific

- Gulf of AK Transients: ≈ 70 whales
- West Coast Transients: ≈ 260 whales
- AT1 Transients: ≈ 7 whales
- ‘California’ Transients: ≈ 150 whales
West coast transient killer whale abundance, 1975-2010

Source: Durban et al. in prep.

+3.0%/yr
Harbour seal is most important prey species of transient killer whales

West Coast Transient diet
(n = 251 marine mammal kills)
Long-term abundance trends of harbour seals in BC

- Transient population growth correlated with increasing harbour seal abundance

*Graph showing estimated population size from 1880 to 2010,*

*Legend:*
- Recent Trends (Aerial Surveys)
- Historic Reconstruction (Mean Estimate)
- Historic Reconstruction (2.5 & 97.5 Percentiles)

Conclusions

• Most killer whale populations in coastal NE Pacific are increasing in abundance
• Positive growth may be due to recovery from depletion (residents) or increasing carrying capacity (WC transients)
• Southern resident population is relatively small and vulnerable
• Potential factors affecting recovery of SRKW:
  - limited food resources
  - contaminants
  - noise/disturbance
  - inbreeding depression
• Synergistic effects of these stressors may be important