

EARTHWATCH INSTITUTE FIELD REPORT 2003 & 2004 - ORCA SURVEY

SECTION 1: UNEP-WCMC WEBLINK INFORMATION

- I. **Project Title:**
Orca Survey
- II. **Principal Investigators:**
Kenneth C. Balcomb, III and Dr. Astrid van Ginneken
- III. **Position/Affiliations:**
Ken Balcomb: Executive Director and research biologist
Astrid van Ginneken: Co-principal Investigator
- IV. **Research Site:**
San Juan Island, Washington State
- V. **Local Management Status of Research Site i.e. National park, RAMSAR, World Heritage Site etc**
none
- VI. **Scientific Names of Primary Species Being Studied**
Orcinus orca
- VII. **Key Research Objectives**
 - Photo-identify each individual killer whale in the study area in 2003
 - Document new offspring in 2004
 - Document the status of each previous year's offspring
 - Document when the whales occur in the study area
 - Document which whales are missing from the population
 - Document and photo-identify other cetacean species in the study area whenever possible
- VIII. **Data Collection and Results**
 - a. **2003 and 2004 Field Season**

Fifty two Earthwatch volunteers in a total of nine teams assisted with the Orca Survey project this year. Volunteers took digital photographs of the whales, collected weather, route, wind, tide and prey information along with vessel, orca and other marine mammal behavior data. They also downloaded and filed photos, entered data into the computer, printed identification photographs of each whale for the annual catalogue, and assisted with housekeeping and vessel maintenance. Data on whales identified in each image were entered into a computer database, and hundreds of pages of data sheet entries were transcribed into a computer program to help interpret whale behavior and correlate it with other databases (e.g., Fisheries and GIS databases).

b. Progress Towards Achieving Original Objectives

We were able to accomplish the primary objectives of photo-identifying each individual killer whale in the study area in 2004, document offspring, and determine which whales were missing.

By the end of the Earthwatch field season, we were able to confirm that two new calves were born, and an additional two calves were born by the end of 2004¹. There was only one missing whale (presumed death, but see footnote 2) noted between the end of the 2003 field and the beginning of the 2004 field season². No whales died during the Earthwatch study season. The population at our Earthwatch field season's end numbered 85 whales, up 8% from 79 three years ago. By the end of the calendar year the population had risen to 87 whales, up from 79 whales three years ago. The population seems to be slowly increasing (Figure 1).

The next stage of our research program involves continuing the photo-identification inventory for several more years while we correlate quantitative fisheries data with whale distribution, and estimate energetic requirements of the whales. This is partly to determine what levels of prey species are required to maintain them in the area, and partly an attempt to identify where and from what species the whales are accumulating their contaminants. It may be important to expand our field season at least through November, and perhaps to year-round for awhile to make this correlation³.

c. Results Summary

Ninety four of the 115 vessel encounters with killer whales in inshore waters in 2004 occurred during the Earthwatch field season (see Table 1). Volunteers downloaded and archived about 213 folders on CD and examined over 19 850 digital images. The best quality left and right side photographs of each whale were put into file folders containing the best photos of each individual. Photos of each side of every living whale were printed as the catalogue of the 87 living whales, as of the end of 2004, was continuously updated.

As noted in earlier Earthwatch Field Reports, orca have been reported in the interior waters more in recent years, and they are foraging more widely within these waters. Salmon stocks in the Pacific Northwest continue to be a disappointment to fisheries managers in general.

Various factors were considered to adversely impact the productivity and reduce harvest opportunities for the Fraser River sockeye this year. These factors included: earlier than normal arrival of certain stocks, lower than normal river discharge and higher than normal water temperatures for most of the summer.

¹ Calf K37 was born to K12, a ~32 year old female who has three surviving offspring (born 1987, 1994 and 1999). Calf L104, born to L43 a ~32 year old female with two surviving offspring (born 1986 and 1996) and calf L105 born to L27 with four deceased offspring.

Both L104 and L105 were born in October. In December two additional calves were born. J40 was born to J14, a 30 year old female who has two surviving offspring (born 1995 and 2001) and one deceased (born 1987). K38 was the first calf born to K20, an 18 year old female.

² The one missing whale this season was: K18, a ~55 year old female.

³ The Chum salmon run to rivers in Puget Sound in the autumn appears to be correlated with whale occurrence, as are the summer runs of Sockeye and Pink salmon in Haro Strait.

High Fraser River temperatures resulted in the Total Allowable Catch of sockeye stocks to be exceeded this year. Higher than normal water temperatures cause adverse affects to migrating salmon including: increased energy expenditure, decreased swimming performance, increased susceptibility to disease, decreased reproductive success, and high mortality. Due to concerns relating to these factors, constraints on the harvest of certain stocks of fish occurred. Fisheries for all areas were only open a few days of each of July and August.

Washington State Fisheries is now managing the silver and king salmon stocks as exclusively sport fisheries. We are still gathering fisheries data from many sources to attempt to correlate whale distribution with fish distribution throughout their range. The data bases from different sources conflict, making it difficult to interpret what is really going on. Nonetheless, it seems as though there is some minimum level of abundance of prey species required to interest the whales to remain in the area, and it would be important to ascertain what that is.

IX. **Significance/Benefits of Research**

a. Benefits to local, national, and international levels:

The results of our study have already contributed immensely to the knowledge of killer whale biology and population dynamics that simply was not knowable from whaling research. Understanding the “normal” demographic parameters has allowed us to ascertain that the southern resident population is recently experiencing anomalous mortality and depressed reproduction. We have brought this disconcerting information to the attention of policy makers whose responsibility it is to ensure that these whales remain at their optimum sustainable population level. The situation is somewhat unique, in that the cause of the decline of the whale population is apparently ecosystem related, rather than one of direct or incidental exploitation.

With increased interest in the whales’ welfare, previously produced television programs about the southern resident killer whales aired locally, nationally and internationally several times this year.

In addition to the above mentioned benefits, research from Orca Survey also contributes the following:

i. Local Benefits

Our current scientific Information on orca biology is made readily available for the local community. Our factual information regarding orca issues is accessible and used in local news publications. The whale watching and related ecotourism industry look to us for up-to-date information to use to educate and inform their passengers about orca. As well, volunteers leave with knowledge of the local community resulting in increased national and international awareness of this area. This awareness will provide more local economic benefits, such as from tourism.

ii. National Benefits

Our research has contributed significantly to the knowledge base of orcas used by national resource managers, such as NOAA Fisheries, the Marine Mammal

Commission, and the Army Corps of Engineers. Many citizens across the nation have learned more about marine environmental issues as a result of their interest in the top predator, orca.

iii. International Benefits

In-depth knowledge from Orca Survey has spread to the global community. Our techniques and basic biological knowledge is being applied to many other orca and photo-id projects globally. Many international volunteers join this project, and they take away valuable knowledge of the challenges and issues occurring here that they can apply for ecosystem management at home.

b. Contribution of Findings to Issues of Sustainability

The local species of orca, as the top marine predator, are an indicator to the health of the Puget Sound ecosystem; therefore, these whales are a good indicator of sustainability of the natural resources in the region. The research findings of the orca survey project show that many issues related to orca population health need to be addressed in Puget Sound. These issues include: high anthropogenic toxin levels in the environment, reduced biological carrying capacity in local fisheries and in surrounding watersheds, and heretofore little understood acoustic impacts in the marine environment.

High levels of Persistent Bioaccumulative Toxins (PBTs) including Polychlorinated Biphenyls (PCBs) have been found in samples taken from recovered bodies of several members of the southern resident killer whales. The northern resident killer whales are significantly less contaminated, suggesting that prey sources are less contaminated within their foraging range. Part of the winter study of southern resident killer whales is to better define the foraging range of these whales, and if possible identify regions/species where contaminated prey resources are being consumed. A very recent study suggests that the whales in BC and Washington state waters may also be threatened by high levels of fire-retardant chemicals (Polybrominated Diphenyl Ethers, or PDBEs) in their tissues and the environment.

In recent years many regional salmon stocks have been dramatically reduced to dangerously low levels, with several species currently listed as endangered under the Endangered Species Act. Wild salmon are the main prey resource for the Southern Resident killer whales, and their northern resident kin. Some wild salmon stocks appear to be recovering under currently favorable ocean conditions, but this is only temporary respite until the root causes of their decline are addressed. Adding to public confusion on this issue, it is important to note that "Farm" salmon obviously are of no benefit to killer whales, because they do not forage in the salmon pens or in supermarkets. On the contrary, most salmon farming situations have been detrimental to wild salmon stocks from escapement, disease and parasite introduction, and contamination of pen sites in natural salmon migratory pathways.

A rising issue for our study whales, and all marine mammals, is that of anthropogenic acoustic impacts on their health and quality of life. Perhaps it is coincidental, but the decline in the southern resident killer whale population began in the year following the deployment of Destroyer Squadron Nine to Everett, WA, in 1995. The Navy squadron's exercise area is nominally off the Olympic Peninsula

encompassing the entire NOAA Olympic Coast National Marine Sanctuary, but it also includes the Strait of Juan de Fuca, Haro Strait and the Whiskey-Golf region in Georgia Strait. We documented extreme avoidance responses by the orca, porpoises and minke whales to intense and prolonged sonar operations in these waters. Responsibly, the US Navy has now strictly regulated the use of mid-frequency tactical sonar in the Pacific Fleet following our bringing this issue to their attention. A Federal fact-finding committee has been convened to provide policy advice to the US Congress on this issue in 2005.

X. Dissemination of Results

a. Scientific Papers

Durban, J.W., Elston, D.A., Ellifrit, D.K., Dickson, E., Hammond, P.S., and P.M. Thompson. 2005. *Multisite mark-recapture for cetaceans: Population estimates with Bayesian model averaging*. Marine Mammal Science 21(1): 80-92.

van Ginneken, A.M. 1990. *Report on the Third International Orca Symposium, Victoria, B.C., Canada, March 9-12, 1990*. Newsletter of the European Cetacean Society 8:5-6

b. Management plans and reports

Balcomb, K.C., J.R. Boran, and S.L. Heimlich. 1990. *Killer whales in greater Puget Sound*. Rep. Int. Whal. Comm. 32:401-406.

Bigg, M.A., P.F. Olesiuk, G.E. Ellis, J.K.B. Ford, and K.C. Balcomb. 1990. *Social organization and genealogy of resident killer whales (Orcinus orca) in the coastal waters of British Columbia and Washington State*. In: Hammond, et. al. (Eds). Individual recognition of Cetaceans. Int. Whal. Comm. Special Issue 12. Cambridge.

c. Presentations

van Ginneken, A.M. *Database and videodisk application for Orca research*. Abstract, presentation, and demonstration. Third International Orca Symposium, Victoria, B.C., Canada, March 9-12. 1990.

van Ginneken, A, and KC Balcomb. 1997. *Can routine data collection benefit killer whale research?* Center for Whale Research. Friday harbor. Wa.

d. Popular articles or films

Balcomb, K.C. 1991. *Kith and kin of the killer whale*. Pacific Discovery. Spring. pp 8-17.

Chadwick, D. 2005. *Deconstructing a killer*. To be published in National Geographic in April.

National Geographic. 2004. *Whales in Crisis*.

Van Ginneken, A.M. 1990. *The Orca: mighty and intelligent hunter (1)*, (In Dutch). Dieren. 1:146-151.

Van Ginneken, A.M. 1990. *The Orca: mighty and intelligent hunter (2)*, (In Dutch). Dieren. 2:164-169.

e. Books, Chapters, illustrations

Balcomb, K.C., Boran JR, Osborne RW, & NJ Haenel. 1980. *Observations of killer whales (Orcinus orca) in Greater Puget Sound.*, State of Washington. Moclips Cetological Society, Incorporated Friday Harbor, Washington.

Ford, J.K.B., G.E. Ellis, and K.C. Balcomb, 2000. 1994. *Killer whales – A study of their identification, genealogy and natural history in British Columbia and Washington State*. UBC Press, Vancouver, BC, Canada.

Van Ginneken, A, Ellifrit, D, & KC Balcomb. 2004. *Official Orca Survey field guide*. Center For Whale Research. Friday Harbor. Washington.