Revised 12/15/2011

HARBOR PORPOISE (*Phocoena phocoena vomerina*): Washington Inland Waters Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the eastern North Pacific Ocean, harbor porpoise are found in coastal and inland waters from Point Barrow, along the Alaskan coast, and down the west coast of North America to Point Conception, California (Gaskin 1984). Harbor porpoise are known to occur year-round in the inland trans-boundary waters of Washington and British Columbia, Canada (Osborne et al. 1988), and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992). Aerial survey data from coastal Oregon and Washington, collected during all seasons, suggest that harbor porpoise distribution varies by depth (Green et al. 1992). Although distinct seasonal changes in abundance along the west coast have been noted, and attributed to possible shifts in distribution to deeper offshore waters during late winter (Dohl et al. 1983, Barlow 1988), seasonal movement patterns are not fully understood.

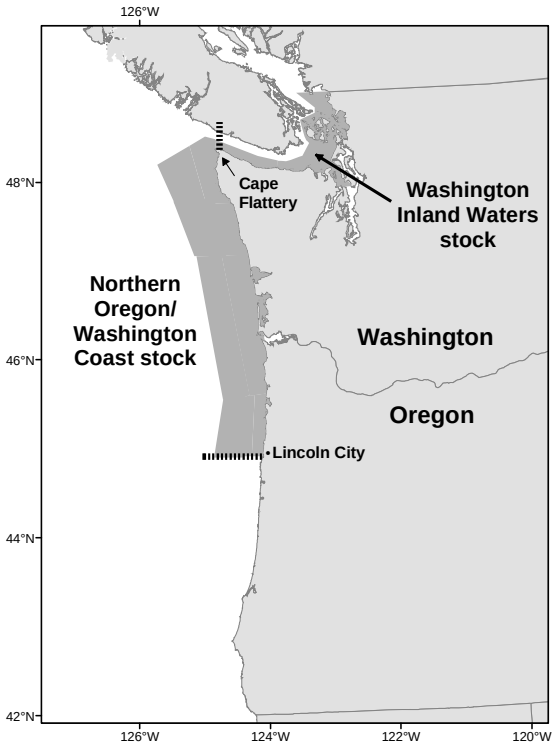

Figure 1. Stock boundaries (dashed lines) and approximate distribution (shaded areas) of harbor porpoise along the coasts of Washington and northern Oregon.

Investigation of pollutant loads in harbor porpoise ranging from California to the Canadian border suggests restricted harbor porpoise movements (Calambokidis and Barlow 1991). Stock discreteness in the eastern North Pacific was analyzed using mitochondrial DNA from samples collected along the west coast (Rosel 1992) and is summarized in Osmek et al. (1994). Two distinct mtDNA groupings or clades exist. One clade is present in California, Washington, British Columbia, and Alaska (no samples were available from Oregon), while the other is found only in California and Washington. Although these two clades are not geographically distinct by latitude, the results may indicate a low mixing rate for harbor porpoise along the west coast of North America. Further genetic testing of the same data, along with additional samples, found significant genetic differences for four of the six pair-wise comparisons between the four areas investigated: California, Washington, British Columbia, and Alaska (Rosel et al. 1995). These results demonstrate that harbor porpoise along the west coast of North America are not panmictic or migratory and that movement is sufficiently restricted that genetic differences have evolved. Recent preliminary genetic analyses of samples ranging from Monterey Bay, California, to Vancouver Island, British Columbia, indicate that there is small-scale subdivision within the U.S. portion of this range (Chivers et al. 2002, 2007). This is consistent with low movement suggested by genetic analysis of harbor porpoise specimens from the North Atlantic, where numerous stocks have been delineated with clinal differences over areas as small as the waters surrounding the British Isles.

Using the 1990-1991 aerial survey data of Calambokidis et al. (1993) for water depths <50 fathoms, Osmek et al. (1996) found significant differences in harbor porpoise mean densities ($Z=6.9$, $P<0.001$) between the waters of coastal Oregon/Washington and inland Washington/southern British Columbia, Canada (i.e., Strait of Juan de Fuca/San Juan Islands). Following a risk averse management strategy, two stocks were recognized in the waters of Oregon and Washington, with a boundary at Cape Flattery, Washington. Based on recent genetic evidence, which suggests that the population of eastern North Pacific harbor porpoise is more finely structured (Chivers et al. 2002, 2007), stock boundaries on the Oregon/Washington coast have been revised, resulting in three stocks in Oregon/Washington waters: a Northern California/Southern Oregon stock (Point Arena, CA, to Lincoln City, OR), a Northern Oregon/Washington Coast stock (Lincoln City, OR, to Cape Flattery, WA), and the Washington Inland

Waters stock (in waters east of Cape Flattery). Additional analyses are needed to determine whether to adjust the stock boundaries for harbor porpoise in Washington inland waters (Chivers et al. 2007).

In their assessment of California harbor porpoise, Barlow and Hanan (1995) recommended two stocks be recognized in California, with the stock boundary at the Russian River. Based on recent genetic findings (Chivers et al. 2002, 2007), California coast stocks were re-evaluated and significant genetic differences were found among four identified sampling sites. Revised stock boundaries, based on these genetic data and density discontinuities identified from aerial surveys, resulted in six California/Oregon/Washington stocks where previously there had been four (e.g., Carretta et al. 2001): 1) the Washington Inland Waters stock, 2) the Northern Oregon/Washington Coast stock, 3) the Northern California/Southern Oregon stock, 4) the San Francisco-Russian River stock, 5) the Monterey Bay stock, and 6) the Morro Bay stock. The stock boundaries for animals that occur in northern Oregon/Washington waters are shown in Figure 1. This report considers only the Washington Inland Waters stock. Stock assessment reports for Northern Oregon/Washington Coast, Northern California/Southern Oregon, San Francisco-Russian River, Monterey Bay, and Morro Bay harbor porpoise also appear in this volume. Stock assessment reports for the three harbor porpoise stocks in the inland and coastal waters of Alaska, including 1) the Southeast Alaska stock, 2) the Gulf of Alaska stock, and 3) the Bering Sea stock, are reported separately in the Stock Assessment Reports for the Alaska Region. The harbor porpoise occurring in British Columbia have not been included in any of the U.S. stock assessment reports.

POPULATION SIZE

Aerial surveys of the inside waters of Washington and southern British Columbia were conducted during August of 2002 and 2003 (J. Laake, unpublished data). These aerial surveys included the Strait of Juan de Fuca, San Juan Islands, Gulf Islands, and Strait of Georgia, which includes waters inhabited by the Washington Inland Waters stock of harbor porpoise as well as harbor porpoise from British Columbia. An average of the 2002 and 2003 estimates of abundance in U.S. waters results in an uncorrected abundance of 3,123 (CV= 0.10) harbor porpoise in Washington inland waters (J. Laake, unpublished data). When corrected for availability and perception bias, using a correction factor of 3.42 (1/g(0); g(0)=0.292, CV=0.366) (Laake et al. 1997), the estimated abundance for the Washington Inland Waters stock of harbor porpoise in 2002/2003 is 10,682 (CV=0.38) animals (J. Laake, unpublished data). However, because the most recent abundance estimate is >8 years old, there is no current estimate of abundance available for this stock.

Minimum Population Estimate

No current information on abundance is available to obtain a minimum population estimate for the Washington Inland Waters stock of harbor porpoise.

Current Population Trend

There are no reliable data on long-term population trends of harbor porpoise for most waters of Oregon, Washington, or British Columbia, however, the uncorrected estimate of abundance in Washington inland waters was significantly greater in 2002/2003 than in 1996 (3,123 vs. 1,025; Z=6.16, P<0.0001) (Calambokidis et al. 1997; J. Laake, unpublished data).

In southern Puget Sound, harbor porpoise were common in the 1940s (Scheffer and Slipp 1948), but marine mammal surveys (Everitt et al. 1980), stranding records since the early 1970s (Osmek et al. 1995), and harbor porpoise surveys in 1991 (Calambokidis et al. 1992) and 1994 (Osmek et al. 1995) indicated that harbor porpoise abundance had declined in southern Puget Sound. In 1994, a total of 769 km of vessel survey effort and 492 km of aerial survey effort conducted during favorable sighting conditions produced no sightings of harbor porpoise in southern Puget Sound. Reasons for the apparent decline are unknown, but it may have been related to fishery interactions, pollutants, vessel traffic, or other factors (Osmek et al. 1995). In 2009 and 2010, however, increased numbers of harbor porpoise have been sighted during vessel surveys throughout Puget Sound and increased numbers of strandings have also been documented, suggesting a return of animals to this region (J. Calambokidis, unpublished data; B. Hanson, unpublished data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is not available for harbor porpoise. Therefore, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% (Wade and Angliss 1997) be employed for the Washington Inland Waters harbor porpoise stock.

POTENTIAL BIOLOGICAL REMOVAL

Because there is no current estimate of minimum abundance, a potential biological removal (PBR) cannot be calculated for this stock.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Fishing effort in the northern Washington marine gillnet tribal fishery is conducted within the range of both harbor porpoise stocks (Northern Oregon/Washington Coast and Washington Inland Waters) occurring in Washington State waters (Gearin et al. 1994). Some movement of harbor porpoise between Washington's coastal and inland waters is likely, but it is currently not possible to quantify the extent of such movements. For the purposes of this stock assessment report, the animals taken in waters east of Cape Flattery, WA, are assumed to have belonged to the Washington Inland Waters stock, and Table 1 includes data only from that portion of the fishery. There was no observer coverage in the northern Washington marine set gillnet tribal fishery in inland waters in 2005-2009; however, there were two fisherman self-reports of harbor porpoise deaths in 2008 and both deaths occurred in nets that were equipped with alarms (Makah Fisheries Management, unpublished data). The mean estimated mortality for this fishery in 2005-2009 is 0.4 harbor porpoise per year from fisherman self-reports. Fishing effort in the northern Washington marine drift gillnet tribal fishery in inland waters is also conducted within the range of the Washington Inland Waters stock of harbor porpoise. This fishery is not observed; however, there was one fisherman self-report of a harbor porpoise death in 2008 (Makah Fisheries Management, unpublished data). The mean estimated mortality for this fishery in 2005-2009 is 0.2 harbor porpoise per year from fisherman self-reports. There were also fisherman self-reports of six unidentified small odontocete deaths in this fishery in 2005 (Makah Fisheries Management, unpublished data); these animals may have been harbor porpoise, but they are not included in the mortality estimate for this fishery.

In 1993, as a pilot for future observer programs, NMFS in conjunction with the Washington Department of Fish and Wildlife (WDFW) monitored non-treaty components (areas 7, 7A, 7B/7C, 8A/8D, 10/11, and 12/12A/12B) of the Washington Puget Sound Region salmon gillnet fishery (Pierce et al. 1994). Observer coverage was 1.3% overall, ranging from 0.9% to 7.3% for the various components of the fishery. No harbor porpoise deaths were reported. Pierce et al. (1994) cautioned against extrapolating this mortality to the entire Puget Sound fishery due to the low observer coverage and potential biases inherent in the data. The area 7/7A sockeye landings represented the majority of the non-treaty salmon landings in 1993, approximately 67%. Results of this pilot study were used to design the 1994 observer programs discussed below.

In 1994, NMFS in conjunction with WDFW conducted an observer program during the Puget Sound non-treaty chum salmon gillnet fishery (areas 10/11 and 12/12B). A total of 230 sets were observed during 54 boat trips, representing approximately 11% observer coverage of the 500 fishing boat trips comprising the total effort in this fishery, as estimated from fish ticket landings (Erstad et al. 1996). No harbor porpoise were reported within 100 m of observed gillnets. The Puget Sound treaty chum salmon gillnet fishery in Hood Canal (areas 12, 12B, and 12C) and Puget Sound treaty sockeye/chum gillnet fishery in the Strait of Juan de Fuca (areas 4B, 5, and 6C) were also monitored in 1994 (NWIFC 1995). No harbor porpoise deaths were reported in the observer programs covering these treaty salmon gillnet fisheries, where observer coverage was estimated at 2.2% (based on % of total catch observed) and approximately 7.5% (based on % of observed trips to total landings), respectively.

Also in 1994, NMFS in conjunction with WDFW and the Tribes conducted an observer program to examine seabird and marine mammal interactions with the Puget Sound treaty and non-treaty sockeye salmon gillnet fishery (areas 7 and 7A). During this fishery, observers monitored 2,205 sets, representing approximately 7% of the estimated 33,086 sets occurring in the fishery (Pierce et al. 1996). There was one observed harbor porpoise death (one other was entangled and released alive with no indication that it was injured), resulting in a mortality rate of 0.00045 harbor porpoise per set, which extrapolates to 15 deaths (CV=1.0) for the entire fishery.

It should be noted that the 1994 observer programs did not sample all segments of the entire Washington Puget Sound Region salmon set/drift gillnet fishery and, further, the extrapolations of total kill did not include effort for the unobserved segments of this fishery. Although the percentage of the overall Washington Puget Sound Region salmon set/drift gillnet fishery effort that was observed in 1994 was not quantified, the observer programs covered those segments of the fishery which had the highest salmon catches, the majority of vessel participation, and the highest likelihood of interaction with harbor porpoise (J. Scordino, pers. comm.). Harbor porpoise takes in the Washington Puget Sound Region salmon drift gillnet fishery are unlikely to have increased since the fishery was last observed in 1994, due to reductions in the number of participating vessels and available fishing time (see details in Appendix 1). Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids.

In 1996, Washington Sea Grant Program conducted a test fishery in the non-treaty sockeye salmon gillnet fishery (area 7) to compare entanglement rates of seabirds and marine mammals and catch rates of salmon using three experimental gears and a control (monofilament mesh net). The experimental nets incorporated highly visible mesh in the upper quarter (50 mesh gear) or upper eighth (20 mesh gear) of the net or had low-frequency sound emitters attached to the corkline (Melvin et al. 1997). In 642 sets during 17 vessel trips, 2 harbor porpoise were killed in the 50 mesh gear.

Table 1. Summary of incidental mortality and serious injury of harbor porpoise (Washington Inland Waters stock) in commercial and tribal fisheries that might take this species and calculation of the mean annual mortality rate; n/a indicates that data are not available. Mean annual takes are based on 2005-2009 data unless noted otherwise.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
Northern WA marine set gillnet (tribal fishery in inland waters)[1]	2005	observer data	0%	n/a	n/a	n/a
	2006		0%	n/a	n/a	
	2007		0%	n/a	n/a	
	2008		0%	n/a	n/a	
	2009		0%	n/a	n/a	
	2008	fisherman self-reports		2	n/a	≥0.4 (n/a)
Northern WA marine drift gillnet (tribal fishery in inland waters)[1]	2008	fisherman self-reports		1	n/a	≥0.2 (n/a)
WA Puget Sound Region salmon set/drift gillnet (observer programs listed below covered segments of this fishery):	-	-	-	-	-	-
Puget Sound non-treaty salmon gillnet (all areas and species)	1993	observer data	1.3%	0	0	see text[2]
Puget Sound non-treaty chum salmon gillnet (areas 10/11 and 12/12B)	1994	observer data	11%	0	0	see text[2]
Puget Sound treaty chum salmon gillnet (areas 12, 12B, and 12C)	1994	observer data	2.2%	0	0	see text[2]
Puget Sound treaty chum and sockeye salmon gillnet (areas 4B, 5, and 6C)	1994	observer data	7.5%	0	0	see text[2]
Puget Sound treaty and non-treaty sockeye salmon gillnet (areas 7 and 7A)	1994	observer data	7%	1	15	see text[2]
Puget Sound non-treaty salmon drift gillnet (area 5)	2006	fisherman self-reports		2	n/a	≥0.4 (n/a)
Unknown Puget Sound Region fishery	2005-2009	stranding data		0, 1, 1, 0, 4	n/a	≥1.2 (n/a)
Minimum total annual takes						≥2.2 (n/a)

[1]This is a tribal fishery; therefore, it is not listed in the NMFS list of commercial fisheries.
[2]This fishery has not been observed since 1994 (see text); these data are not included in the calculation of recent minimum total annual takes.

There were two fisherman self-reports of harbor porpoise deaths in the Puget Sound Region salmon drift gillnet fishery in area 5 in 2006, resulting in an estimated mean annual mortality rate of 0.4 harbor porpoise from fisherman self-reports. There was also a fisherman self-report of an unidentified neonate or juvenile porpoise death

in the Puget Sound Region drift gillnet fishery in 2006; this animal may have been a harbor porpoise, but it was not included in the mortality estimate for the fishery.

Combining estimates from the northern Washington marine set gillnet tribal fishery (0.4), the northern Washington marine drift gillnet tribal fishery (0.2), and the Puget Sound Region drift gillnet fishery (0.4) results in an estimated mean annual mortality rate of 1.0 harbor porpoise from this stock from fisherman self-reports.

Strandings of harbor porpoise wrapped in fishing gear or with serious injuries caused by interactions with gear are a final source of fishery-related mortality information. According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region (NMFS, Northwest Regional Office, unpublished data), there were six fishery-related strandings of harbor porpoise from this stock in 2005-2009 (1 in 2006, 1 in 2007, and 4 in 2009), resulting in an average annual mortality of 1.2 harbor porpoise. Evidence of fishery interactions included entanglement in gillnet, net marks, and rope marks. Since these deaths could not be attributed to a particular fishery, and were the only confirmed fishery-related deaths in this area in 2005-2009, they are listed in Table 1 as occurring in an unknown Puget Sound Region fishery. One additional harbor porpoise stranding reported in 2007 was considered a possible fishery-related death, but it was not included in the estimate of average annual mortality. This estimate is considered a minimum because not all stranded animals are found, reported, or examined for cause of death (via necropsy by trained personnel).

Although, commercial gillnet fisheries in Canadian waters are known to have taken harbor porpoise in the past (Barlow et al. 1994, Stacey et al. 1997), few data are available because the fisheries were not monitored. In 2001, the Department of Fisheries and Oceans, Canada, conducted a federal fisheries observer program and a survey of license holders to estimate the incidental mortality of harbor porpoise in selected salmon fisheries in southern British Columbia (Hall et al. 2002). Based on the observed bycatch of porpoise (2 harbor porpoise deaths) in the 2001 fishing season, the estimated mortality for southern British Columbia in 2001 was 20 porpoise per 810 boat days fished or a total of 80 harbor porpoise. However, it is not known how many harbor porpoise from the Washington Inland Waters stock are currently taken in the waters of southern British Columbia.

Other Mortality

According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region (NMFS, Northwest Regional Office, unpublished data), two human-caused harbor porpoise deaths were reported from non-fisheries sources in 2005-2009. One animal was struck by a ship in 2007 and one was entangled in rope in 2009, resulting in an estimated mortality of 0.4 harbor porpoise per year from this stock.

A significant increase in the number of harbor porpoise strandings reported throughout Oregon and Washington in 2006 prompted the Working Group on Marine Mammal Unusual Mortality Events to declare an Unusual Mortality Event (UME) on 3 November 2006 (Huggins 2008). A total of 114 harbor porpoise strandings were reported and confirmed throughout Oregon/Washington coast and Washington inland waters in 2006 and 2007 (Huggins 2008). The cause of the UME has not been determined and several factors, including contaminants, genetics, and environmental conditions, are still being investigated. Cause of death, determined for 48 of 81 porpoise that were examined in detail, was attributed mainly to trauma and infectious disease. Suspected or confirmed fishery interactions were the primary cause of adult/subadult traumatic injuries, while birth-related trauma was responsible for the neonate deaths. Although five of the Washington Inland Waters harbor porpoise deaths examined as part of the UME were suspected to have been caused by fishery interactions, only four could be confirmed as fishery-related deaths; two of these harbor porpoise deaths were self-reported by the Puget Sound Region salmon gillnet fishery in 2006 and the other two deaths (1 in 2006 and 1 in 2007) are listed in Table 1 as occurring in an unknown Puget Sound Region fishery.

STATUS OF STOCK

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act. Based on currently available data, the total level of human-caused mortality and serious injury is 2.6 (2.2 + 0.4) harbor porpoise per year. A PBR cannot be calculated for this stock because there is no current abundance estimate. The previous estimate of PBR was 63 (Carretta et al. 2009). Human-caused mortality relative to PBR is unknown, but it is considered to be small relative to the stock size. Therefore, the Washington Inland Waters harbor porpoise stock is not classified as "strategic." The minimum total fishery mortality and serious injury for this stock is 2.2 harbor porpoise per year (based on self-reported fisheries information (1.0) and stranding data (1.2) where observer data were not available or failed to detect harbor porpoise mortality). Since a PBR cannot be calculated for this stock, fishery mortality relative to PBR is unknown. The status of this stock relative to its Optimum Sustainable Population (OSP) level and population trends is unknown.

Although harbor porpoise sightings in southern Puget Sound declined from the 1940s through the 1990s, harbor porpoise have been sighted in southern Puget Sound in recent vessel surveys.

This stock is not recognized as "strategic," however, the current mortality rate is based on fisherman self-reports and stranding data, since the Washington Puget Sound Region salmon set/drift gillnet fishery has not been observed since 1994. Evaluation of the estimated take level is complicated by a lack of knowledge about the extent to which harbor porpoise from U.S. waters frequent the waters of British Columbia and are, therefore, subject to fishery-related mortality. It is appropriate to consider whether the current take level is different from the take level in 1994, when the fishery was last observed. No new information is available about mortality per set, but 1) fishing effort has decreased in recent years and 2) analysis of data from aerial surveys in 2002 and 2003 indicates that abundance has increased since 1996.

REFERENCES

Barlow, J. 1988. Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon, and Washington: I. Ship surveys. Fish. Bull. 86:417-432.

Barlow, J., and D. Hanan. 1995. An assessment of the status of harbor porpoise in central California. Rep. Int. Whal. Commn. Special Issue 16:123-140.

Barlow, J., C. W. Oliver, T. D. Jackson, and B. L. Taylor. 1988. Harbor porpoise, *Phocoena phocoena,* abundance estimation for California, Oregon, and Washington: II. Aerial surveys. Fish. Bull. 86:433-444.

Barlow, J., R. W. Baird, J. E. Heyning, K. Wynne, A. M. Manville, II, L. F. Lowry, D. Hanan, J. Sease, and V. N. Burkanov. 1994. A review of cetacean and pinniped mortality in coastal fisheries along the west coast of the USA and Canada and the east coast of the Russian Federation. Rep. Int. Whal. Commn. Special Issue 15:405-425.

Calambokidis, J. Cascadia Research Collective, 218 1/2 W 4th Avenue, Olympia, WA 98501.

Calambokidis, J., and J. Barlow. 1991. Chlorinated hydrocarbon concentrations and their use for describing population discreteness in harbor porpoises from Washington, Oregon, and California. Pp. 101-110, *In:* Reynolds, J. E., III, and D. K. Odell (eds.), Proceedings of the second marine mammal stranding workshop: 3-5 December 1987, Miami, Florida. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 98.

Calambokidis, J., J. R. Evenson, J. C. Cubbage, P. J. Gearin, and S. D. Osmek. 1992. Harbor porpoise distribution and abundance off Oregon and Washington from aerial surveys in 1991. Final Report by Cascadia Research, Olympia, WA, to National Marine Mammal Laboratory, AFSC, NMFS, Seattle, WA. 44 pp.

Calambokidis, J., J. C. Cubbage, J. R. Evenson, S. D. Osmek, J. L. Laake, P. J. Gearin, B. J. Turnock, S. J. Jeffries, and R. F. Brown. 1993. Abundance estimates of harbor porpoise in Washington and Oregon waters. Final Report by Cascadia Research, Olympia, WA, to National Marine Mammal Laboratory, AFSC, NMFS, Seattle, WA. 55 pp.

Calambokidis, J., S. D. Osmek, and J. L. Laake. 1997. Aerial surveys for marine mammals in Washington and British Columbia inside waters. Final Report by Cascadia Research, Olympia, WA, to National Marine Mammal Laboratory, AFSC, NMFS, Seattle, WA. 96 pp.

Carretta, J. V., J. Barlow, K. A. Forney, M. M. Muto, and J. Baker. 2001. U.S. Pacific marine mammal stock assessments: 2001. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-317. 280 pp.

Carretta, J. V., K. A. Forney, M. S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, M. M. Muto, D. Lynch, and L. Carswell. 2009. U.S. Pacific marine mammal stock assessments: 2008. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-434. 336 pp.

Chivers, S. J., A. E. Dizon, P. J. Gearin, and K. M. Robertson. 2002. Small-scale population structure of eastern North Pacific harbour porpoises (*Phocoena phocoena*) indicated by molecular genetic analyses. J. Cetacean Res. Manage. 4(2):111-122.

Chivers, S. J., B. Hanson, J. Laake, P. Gearin, M. M. Muto, J. Calambokidis, D. Duffield, T. McGuire, J. Hodder, D. Greig, E. Wheeler, J. Harvey, K. M. Robertson, and B. Hancock. 2007. Additional genetic evidence for population structure of *Phocoena phocoena* off the coasts of California, Oregon, and Washington. Southwest Fisheries Science Center Administrative Report LJ-07-08. 14 pp. Available at SWFSC, NMFS, 3333 North Torrey Pines Road, La Jolla, CA 92037.

Dohl, T. P., R. C. Guess, M. L. Duman, and R. C. Helm. 1983. Cetaceans of central and northern California, 1980-1983: status, abundance, and distribution. OCS Study MMS 84-0045. Pacific OCS Region Minerals Management Service, 1340 Sixth Street, Los Angeles, CA 90014. 284 pp.

Erstad, P., S. J. Jeffries, and D. J. Pierce. 1996. 1994 Report for the Puget Sound fishery observer program in management areas 10/11 & 12/12B: nontreaty chum gill net fishery. Final Report, Washington Dept. Fish and Wildlife, Olympia, WA. 14 pp.

Everitt, R. D., C. H. Fiscus, and R. L. DeLong. 1980. Northern Puget Sound marine mammals. Interagency Energy/Environment R & D Program Report, U.S. EPA, EPA-600/7-80-139. U.S. EPA, Washington, D.C. 134 pp.

Gaskin, D. E. 1984. The harbour porpoise *Phocoena phocoena* (L.): regional populations, status, and information on direct and indirect catches. Rep. Int. Whal. Commn. 34:569-586.

Gearin, P. J., S. R. Melin, R. L. DeLong, H. Kajimura, and M. A. Johnson. 1994. Harbor porpoise interactions with a chinook salmon set-net fishery in Washington State. Rep. Int. Whal. Commn. Special Issue 15:427-438.

Green, G. A., J. J. Brueggeman, R. A. Grotefendt, C. E. Bowlby, M. L. Bonnel, and K. C. Balcomb, III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. Ch. 1, *In:* Brueggeman, J. J. (ed.), Oregon and Washington marine mammal and seabird surveys. Final Report, OCS Study MMS 91-0093, Minerals Management Service, U.S. Dept. of Interior, Los Angeles, CA.

Hall, A., G. Ellis, and A. W. Trites. 2002. Harbour porpoise interactions with the 2001 selective salmon fisheries in southern British Columbia and license holder reported small cetacean by-catch. Unpublished Report, Selective Salmon Fisheries Science Program, Fisheries and Oceans Canada. 51 pp.

Hanson, B. Northwest Fisheries Science Center, NMFS, 2725 Montlake Boulevard E, Seattle, WA 98112.

Huggins, J. 2008. Request for event closure: 2006-2007 Northwest harbor porpoise unusual mortality event. Unpublished Report by Cascadia Research Collective to NMFS, Northwest Regional Office. 11 pp. Available at NMFS, Northwest Regional Office, 7600 Sand Point Way NE, Seattle, WA 98115.

Laake, J. L. National Marine Mammal Laboratory, AFSC, NMFS, 7600 Sand Point Way NE, Seattle, WA 98115.

Laake, J. L., J. Calambokidis, S. D. Osmek, and D. J. Rugh. 1997. Probability of detecting harbor porpoise from aerial surveys: estimating g(0). J. Wildl. Manage. 61(1):63-75.

Makah Fisheries Management, P.O. Box 115, Neah Bay, WA 98357.

Melvin, E. F., L. L. Conquest, and J. K. Parrish. 1997. Seabird bycatch reduction: new tools for Puget Sound drift gillnet salmon fisheries. 1996 Sockeye and 1995 Chum Salmon Test Fisheries Final Report, Washington Sea Grant Program, Seattle, WA. 48 pp.

National Marine Fisheries Service (NMFS), Northwest Regional Office, 7600 Sand Point Way NE, Seattle, WA 98115.

Northwest Indian Fisheries Commission (NWIFC). 1995. Monitoring of marbled murrelet and marine mammal interactions with 1994 tribal gillnet fisheries in northern Puget Sound, Hood Canal, and the Strait of Juan de Fuca. Final Report to NMFS (Contract No. 52ABNF400087) and U.S. Fish and Wildlife Service. Unpublished Report. 41 pp. Available at NWIFC, 6730 Martin Way E, Olympia, WA 98516.

Osborne, R., J. Calambokidis, and E. M. Dorsey. 1988. A Guide to Marine Mammals of Greater Puget Sound. Island Publishers, Anacortes, WA. 191 pp.

Osmek, S., P. Rosel, A. Dizon, and R. DeLong. 1994. Harbor porpoise, *Phocoena phocoena*, population assessment in Oregon and Washington, 1993. Pp. 1-14, *In:* Braham, H. W., and D. P. DeMaster (eds.), Marine mammal assessment program: status of stocks and impacts of incidental take, 1993. National Marine Mammal Laboratory – MMPA Studies of 1993, NMML, AFSC, NMFS, NOAA. 153 pp. Available at National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115.

Osmek, S., B. Hanson, J. L. Laake, S. Jeffries, and R. DeLong. 1995. Harbor porpoise *Phocoena phocoena* population assessment studies for Oregon and Washington in 1994. Pp. 141-172, *In:* DeMaster, D. P., H. W. Braham, and P. S. Hill (eds.), Marine mammal assessment program: status of stocks and impacts of incidental take, 1994. National Marine Mammal Laboratory – MMPA Studies of 1994, NMML, AFSC, NMFS, NOAA. 244 pp. Available at National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115.

Osmek, S., J. Calambokidis, J. Laake, P. Gearin, R. DeLong, J. Scordino, S. Jeffries, and R. Brown. 1996. Assessment of the status of harbor porpoise, *Phocoena phocoena*, in Oregon and Washington waters. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-76. 46 pp.

Pierce, D. J., W. P. Ritchie, and R. Kreuziger. 1994. Preliminary findings of seabird interactions with the non-treaty salmon gill net fishery: Puget Sound and Hood Canal Washington. Unpublished Report, Washington Dept. Fish and Wildlife, Olympia, WA. 39 pp. Available at WDFW, 600 Capitol Way N, Olympia, WA 98501.

Pierce, D. J., M. Alexandersdottir, S. J. Jeffries, P. Erstad, W. Beattie, and A. Chapman. 1996. Interactions of marbled murrelets and marine mammals with the 1994 Puget Sound sockeye gill net fishery. Final Report, Washington Dept. Fish and Wildlife, Olympia, WA. 21 pp. Available at WDFW, 600 Capitol Way N, Olympia, WA 98501.

Rosel, P. E. 1992. Genetic population structure and systematic relationships of some small cetaceans inferred from mitochondrial DNA sequence variation. Ph.D. Thesis, University of California - San Diego, La Jolla, CA. 191 pp.

Rosel, P. E., A. E. Dizon, and M. G. Haygood. 1995. Variability of the mitochondrial control region in populations of the harbour porpoise, *Phocoena phocoena*, on inter-oceanic and regional scales. Can. J. Fish. Aquat. Sci. 52:1210-1219.

Scheffer, V. B., and J. W. Slipp. 1948. The whales and dolphins of Washington State with a key to the cetaceans of the west coast of North America. Am. Midl. Nat. 39(2):257-337.

Scordino, J. National Marine Fisheries Service, Northwest Region, 7600 Sand Point Way NE, Seattle, WA 98115.

Stacey, P. J., R. W. Baird, and D. A. Duffus. 1997. A preliminary evaluation of incidental mortality of small cetaceans in coastal fisheries in British Columbia, Canada. Mar. Mammal Sci. 13:321-326.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12. 93 pp.