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Abstract

Summer Resident Gray Whales of Washington State:
Policy, Biological and Management Implications of Makah Whaling

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Several hundred gray whales that feed in the waters of Washington State (W.S.) and the Pacific Northwest through the spring, summer, and early fall exhibit site faithful behavior. These animals have been referred to as "seasonal residents". Site fidelity can indicate a social or genetic distinction of one part of a species relative to the whole, although data are not currently available to test such hypotheses. Studies of site fidelity observed in the humpback whale have resulted in the recognition of genetically distinct aggregations within populations that were once considered panmictic, leading to the development of management strategies for the conservation of these aggregations.

Management issues regarding gray whales that feed in the waters of W.S. were highlighted by the resumption of aboriginal whaling by the Makah Tribe in 1998 and 1999. The recognition of potential problems associated with harvesting seasonal residents has resulted in the Makah developing a management plan for whaling that specifically targets migratory animals. However, procedures and methods for distinguishing between seasonal residents and migrants remain problematic. Further, logistical constraints imposed to maximize the chance of taking migrants may prove unworkable and or unsafe.

For the Makah Tribe to meet their subsistence and ceremonial needs, an intentional or incidental harvest from the seasonal residents may be unavoidable. Until more information is known about this aggregation, management plans and policies should take a precautionary approach. Possible changes to the existing management plan should be based on: 1) making the assumption that seasonal residents are a distinct population segment of the eastern stock of the North Pacific gray whale, 2) an estimation of whether

this feeding aggregation is large enough to sustain some level of removals, and 3) re-negotiation of the management agreement between the Makah Tribe and the U.S.

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List of Abbreviations and Acronyms

ASWSC	Aboriginal Subsistence Whaling Sub Committee
CRC	Cascadia Research Collective
CPS	Central Puget Sound
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
ESA	Endangered Species Act
GH	Grays Harbor
ICRW	International Convention for the Regulation of Whaling
IWC	International Whaling Convention
IWS	International Whaling Statistics
K	Carrying Capacity
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MNPL	Maximum Net Productivity Level
MSY	Maximum Sustainable Yield
NEPA	National Environmental Protection Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NMSA	National Marine Sanctuary Act
NOAA	National Oceanic and Atmospheric Administration
NPS	North Puget Sound
NRC	National Research Council
OC	Outer Coast
OPS	Optimum Sustainable Population
PBR	Potential Biological Removal
PS	Protection Stock

RMP	Revised Management Plan
SAR	Stock Assessment Report
SJF	Strait of Juan de Fuca
SMS	Sustained Management Stock
SPS	South Puget Sound
the Line	The Bonilla/Tatoosh line
U.A.	Usual and Accustomed
U.S.	Untied States
WCA	Whaling Convention Act
W.S.	Washington State

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INTRODUCTION

An intricate framework of domestic, tribal, and international whaling polices and regulations have resulted from the recognized over-harvest of many whale populations, conservation efforts and the International Convention for the Regulation of Whaling (ICRW) in 1946. These policies and regulations have required increased ecological and biological understanding of whale populations. Both this increased knowledge as well as shifts in social values attached to whales and whaling, have added to the complexity of managing whale populations. Environmental laws and policies, and domestic and international organizations attempt to address these complexities, yet under many conditions, policy procedures and implementation are unclear. Such is the case with the Washington State gray whales, known as the seasonal residents (also referred to here as the "Washington feeding aggregation", or "summer residents"), and the resumption of subsistence whaling by the Makah Indian Tribe ("Makah Tribe" or "Tribe").

Most of the eastern North Pacific gray whale population is well known for its annual migrations between breeding grounds in Baja California, Mexico and their primary feeding grounds in the Bering and Chukchi Seas. Yet, a smaller aggregation has been observed feeding in the waters of the Pacific Northwest and Washington State (W.S.), including the usual and accustomed (U.A.) whaling grounds of the Makah Tribe (Patten and Samaras 1977, Mallonee 1991, Avery and Hawkins 1992, Sumich 1984, Flaherty 1983, Calambokidis *et al.* 1987, 1991, 1992, 1994, 1997, 1998, 1999, Darling *et al.* 1984, 1998, Murison *et al.* 1984, Plewes *et al.* 1985). Photographic identification has revealed that among these gray whales, a large number of individuals return to this region to feed over periods of many years, a behavior often referred to as "site fidelity" (Switzer 1993). The significance of the seasonal resident whales return to and reuse of the area as a feeding ground is unknown. At one extreme the W.S. feeding ground may be supporting an opportunistic group of gray whales and at the other extreme the group could be a genetically distinct population of the eastern North Pacific stock of gray whales.

The resumption of the Makah Tribe's aboriginal whaling practices has raised concerns regarding a potential need for conservation and protection of the seasonal resident gray whales. Global and local acknowledgement of the potential problems associated with harvesting seasonal residents has resulted in the Makah developing a management plan for whaling that specifically targets migratory animals (as opposed to seasonal residents). Yet the seasonal hunting constraints in the current management plans do not ensure that only migratory whales will be taken and may prove unworkable relative to harvesting animals during the migration periods, when weather and sea conditions add to safety concerns. Future complications may arise as Canadian natives, in regions adjacent to traditional hunting grounds of the Makah Tribe, assert their aboriginal whaling rights, potentially affecting the same "seasonal resident" group (Barber 1998).

The existing political framework in which decisions relating to this issue must be made and polices implemented, further complicates the situation. Polices within three organizations, the International Whaling Commission (IWC), the United States (U.S.) and the Makah Tribe, should be compatible. At one level the U.S. has obligations to the Tribe and the IWC. The Tribe has no obligations to the IWC, and limited obligations to the U.S. This leaves the U.S. having to negotiate plans that harmonize its obligations with both the IWC and the Tribe. Further the U.S. must also be in compliance with its own federal laws, namely the Marine Mammal Protection Act, the National Environmental Protection Act[1] (NEPA), the Endangered Species Act[2] (ESA) and the National Marine Sanctuary Act[3] (NMSA).

The information presented here will addresses the biological status of the seasonal resident gray whale, examine the potential effects of an aboriginal subsistence harvest on the summer residents (Chapter 1), review the related policies (Chapter 2), and evaluate current management practices related to the seasonal residents (Chapter 3). Objectives focus on: 1) identifying policy mandates for the seasonal resident group, and 2) recommending alternative and additional management strategies that address both the

[1] 42 U.S.C. 4321 *et seq.*
[2] 16 U.S.C. 1531 *et seq.*

needs of the Makah Tribe as well as provide conservation and protection for the summer resident gray whales.[3]

[3] 16 U.S.C.1431 *et seq.*

CHAPTER 1

BIOLOGICAL IMPLICATIONS OF THE SUMMER RESIDENT GRAY WHALES AND POTENTIAL EFFECTS OF AN ABORIGINAL HARVEST

A large number of gray whales that feed in the waters of Washington State (W.S.) and the Pacific Northwest through the spring, summer, and early fall exhibit site faithful behavior (Quan *et al.* 1999). These particular gray whales have been commonly referred to as "seasonal residents", distinguishing them from the "migratory" gray whales that pass through the W.S. waters on their way to feeding grounds in the Bering Sea. The seasonal resident group is not legally or formally recognized as being distinct from the entire eastern North Pacific gray whale population, however, their regular return to and reuse of particular areas in the region (a behavior known as site fidelity, Switzer 1993), suggests a distinct segment could exist.

The recent resumption of aboriginal whaling by the Makah Tribe, located in Washington State, has raised concerns as to the potential effects that a harvest may have on this seasonal resident group[4]. The biological significance of the seasonal residents is unclear. This putative population could represent a random gathering of whales that have found feeding success and return regularly, or they may represent a more distinct group that is behaviorally, morphologically or genetically related. Results of a harvest will differ depending on how the group is maintained and the selectivity of the harvest (Fowler 1981). This chapter discusses possible biological implications of the seasonal residents and potential effects of small subsistence harvest.

The Gray Whale[5]

The gray whale, *Eschrichtius robustus,* currently occurs in the North Pacific Ocean, where it inhabits primarily coastal waters. Gray whales once occurred along the

[4] Metcalf vs. Daley, C985289, currently in the 9th Circuit Court of Appeals
[5] The following summary on gray whales are excerpts from MMC 1996.

eastern and western coasts of the North Atlantic Ocean, and were found along the coast of North America as recently as the 1600's. However the North Atlantic population became extinct, probably around the 1700.

In the North Pacific Ocean two populations (stocks) are recognized: the eastern North Pacific (California) gray whale and the western North Pacific (Korean) gray whale. The eastern North Pacific stock migrates along the coast between winter calving and breeding grounds off Baja California, Mexico and the primary feeding grounds as far north as the Bering and Chukchi Sea. The western stock migrates between summer feeding grounds in the Okhostk Sea and winter breeding areas along the South China Coast.

Historical Background

The gray whale has been a target of aboriginal whalers dating back to the first century (Krupnik 1984) and continues through today (Russian Federation 1997, Quan 1999, IWC 1999). Archeological materials from sites from the northern Chukchi/ Arctic regions, and south along the coastlines of Alaska, Canada and what is now Washington State confirm that natives in these regions hunted gray whales (Dumond 1995, Huelsbeck 1988, Webb 1988, Kirk and Daugherty 1974). For these native groups the gray whale, along with other whale species, provided food, fuel, building materials and means for trade (Dumond 1995).

In the 1840's "western man" began a commercial whale fishery for the eastern North Pacific gray whale in the breeding lagoons off Baja California, Mexico (Henderson 1984). Names like "Hard-head" and "Devil-fish" signified the danger incurred in the pursuit of the gray whale on the breeding ground (Scammon 1969). By the mid-1870's the population had become so severely depleted that the initial whaling grounds where abandoned. The population faced a second round of depletion in the 1900's as well (Henderson 1984). The scarcity of gray whales (and most of the other large whales depleted in a similar manner) is likely to have contributed to a cessation of aboriginal whaling by the Makah (Renker 1996, EA 1997).

International recognition of the depleted state of the gray whale stock began in the early 1900, and was followed by efforts of conservation and protection. In 1937, a majority of the countries involved in the commercial whaling industry (including the United States) signed an international agreement[6] forbidding the take of gray whales. By 1951[7] all internationally recognized whaling nations had signed a similar agreement and the gray whale was protected from all commercial harvest (Henderson 1984). While commercial takes were prohibited, aboriginal subsistence harvests were permitted by Russian and Alaskan Natives. Additionally, in 1959 a small series of gray whales where taken off the California coast under the IWC's Special Scientific Permits, by the U.S. Bureau of Commercial Fisheries (Rice and Wolman 1971).

In the late 1960's and early 1970's the passage of United States laws like the Endangered Species Act[8], and the Marine Mammal Protection Act brought further protection to the gray whales within the U.S. waters. Between the late 1960's and the mid-1990's the eastern North Pacific stock of gray whale increased in abundance from approximately 11,000 (Rice and Wolman 1971) to approximately 23,109[9] (Laake *et al.* 1994). In 1994, the eastern North Pacific gray whale was removed from the United States list of endangered and threatened wildlife[10] (the endanger species list).

Current estimates of this population are greater than 26,000 animals and growing (2.5% per year) (Rugh *et al.* 1999). The western North Pacific (Korean) population, which faced similar pressures from the whale fishery, remains at a depleted level and an endangered status. The eastern North Pacific gray whale is not presently being hunted commercially, and is believed by many to be at or near their pre-exploitation numbers (MMC 1998). Native groups still benefiting from the harvest of eastern North Pacific

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[6] International Agreement for the Regulation of Whaling 1937 – text in International Whaling Statistics (IWS) Vol. 16, Pp. 58-66 and Vol. 17, Pp. 26-34

[7] Agreements of the International Convention for the Regulation of Whaling (ICRW) in 1946, were not active until 1951

[8] In June of 1970 the gray whale was recognized, under the Endangered Species Conservation Act of 1969 as being threatened with extinction, and listed as "endangered" under the Endangered Species Act of 1973.

[9] This is the estimated abundance for the years 1993/94.

[10] 59 FR 31094 - 16 June 1994 U.S. Fish and Wildlife Service removed the Eastern North Pacific stock of gray whales from the List under the ESA

gray whales are the Chukotka natives on Russia's Chukchi Peninsula, and the Makah Indian Tribe located in Washington State.

Gray Whales of Washington State

The gray whales encountered in the Washington State waters are considered part of the eastern North Pacific stock of gray whale. This population, well known for its long migration between breeding grounds in Baja California, Mexico and summer feeding grounds in the Bering sea (Figure 1), have also been observed in smaller groups from early spring to late fall in the coastal waters of Washington State (Calambokidis *et al.* 1994, Calambokidis and Quan 1999). Within the waters of Washington State, gray whales are seen in the Puget Sound, the Strait of Juan de Fuca, and along the outer coastline of the state (Figure 2). Generally, gray whales appear in these areas around March, during the northbound (spring) migration and seem to diminish in numbers around December (Darling *et al.* 1998), during the time of the southbound (fall) migration (Calambokidis *et al.* 1994).

Figure 1. Gray whales make one of the longest migrations of any mammal, traveling from their breeding grounds off Baja California, Mexico to their principal feeding grounds off Alaska.

Gray whale occurrences in the Washington State waters display three roughly regional trends (Calambokidis and Quan 1999) (Figure 2):

- Northern Puget Sound (NPS)- Gray whales seen in northern Puget Sound show strong site fidelity to particular sites, but only for part of the season and then move to other unknown areas.
- Central and Southern Puget Sound (CPS and SPS) - Utilization of sites in central and southern Puget Sound are highly variable from year to year. Whales seen in these areas have a high mortality rate and are rarely seen in more than one year.
- Outer Coast, Strait of Juan de Fuca, and Grays Harbor (OC, SJF, GH) - The gray whales observed on the outer coast of W.S. show some localized fidelity to certain sites but also move widely within and between areas and are not always observed annually. While some of these gray whales are seen in the Strait of Juan de Fuca and

along the southern coastline of Vancouver Island (BC) they are not seen inside Puget Sound (in the NPS,CPS or SPS regions).

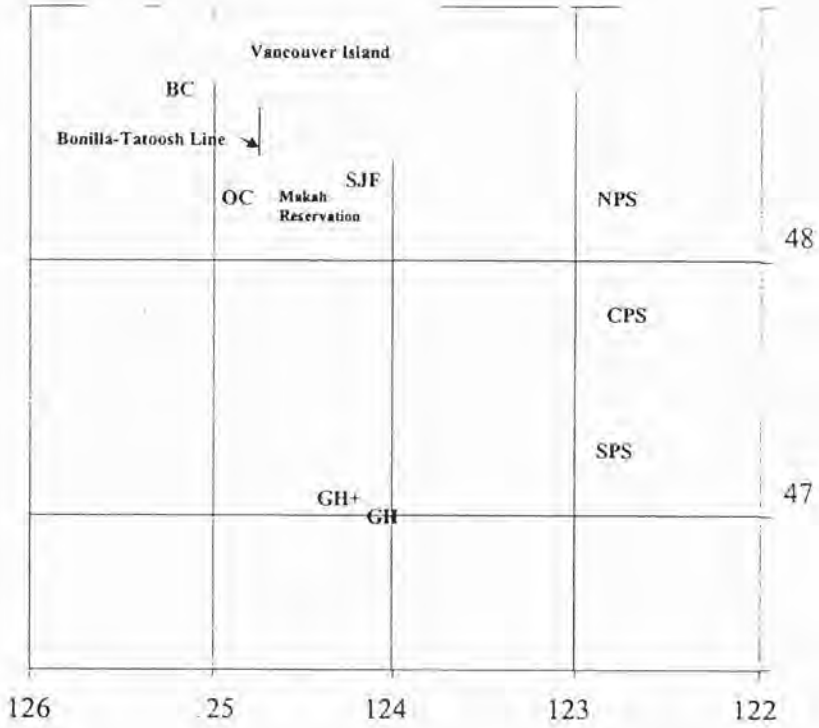

Figure 2. Regional ..estinations of summer resident gray whales in WS.

The gray whales seen in the OC and SJF regions are the seasonal resident whales most likely to be effected by the Makah harvest (and thus will be the seasonal resident group referred to from henceforth). Photographic identification research on these whales has revealed that over periods of up to 20 years a large number of the animals seen in these waters return regularly (Darling *et al.* 1998, Calambokidis *et al.* 1987, 1991, 1992, 1994, 1997,1999). Methods and efforts to collect these identifications are well documented in several reports to the National Marine Mammal Laboratory (NMML)(see Calambokidis *et al.* 1987, 1991, 1992, 1994, 1997,1999). The information presented here profiles only the whales seen on the outer Washington Coast from Grays Harbor to Cape Flattery, in the Strait of Juan de Fuca and along the southern edge of Vancouver Island,

BC. Only data collected by either Cascadia Research Collective or biologists at the National Marine Mammal Laboratory were used[11] .

Between 1986 and 1998, 156 gray whales have been photographically identified off the outer Washington Coast from Grays Harbor to Cape Flattery, in the Strait of Juan de Fuca and along the southern edge of Vancouver Island, B.C. (Appendix B). A total of 92 individual whales have been photographed in the OC and SJF regions (Table 1). Of these animals 21 individuals have been identified in both the OC and SFJ regions, and 24 of these animals have been observed by Cascadia Research Collective or NMML in the BC and or GH regions. Of the individuals observed in this region 73% have been observed multiple times (more than one day), and 61 % have been identified in more than one year (between two and six years).

Table 1. Sighting profile of summer resident whales seen in the outer coast (OC) and Strait of Juan de Fuca (SJF) regions. Calculations of re-sightings included sightings from other regions: British Columbia (BC), Grays Harbor (GH), and out side Grays Harbor (GH+).

		Re-sightings	
Year	# of individual gray whales identified in the OC and SFJ regions	Percent of individuals seen > 1day	Percent of individuals seen in other years
1993	25	64%	56%
1994	10	40%	70%
1995	22	59%	64%
1996	19	74%	84%
1997	27	89%	81%
1998	35	71%	51%

[11] Currently there is on going collaborative work with researchers in British Columbia, California and Oregon where the collection of additional photographs has revealed movements of the summer resident gray whales among, all of these areas (Calambokidis and Quan 1999). The data is undergoing further analysis.

Feeding is the primary behavior observed by gray whales in these waters (Darling *et al.* 1998, Calambokidis 1994, Wietkamp 1991). Mud plumes and sandpits created by foraging for benthic prey have been observed in the W.S. waters. Darling *et al.* (1998) reported a variety of prey species, foraging techniques and habitat utilization, of gray whales observed off Vancouver Island.

Site Fidelity and Seasonal Residence

Site fidelity describes the return to and reuse of a previously occupied location (Switzer 1993). Humpback whales exhibit maternally directed site fidelity to feeding areas, to which they return on a seasonal (and predictable) basis (Baker *et al.* 1990). Site fidelity in seasonal residency has been documented in other species, such as in west Indian manatees in Florida (Ried *et al.* 1991), and white-Fronted geese in Greenland (Wilson *et al.*1991). Strong site faithful behavior can be an indicator that animals will be less likely to move or select new habitat (even when traditional habitat conditions become less favorable), rather than face the cost of changing territories (Wilson *et al.* 1991, and Switzer 1993).

The term "resident", when applied to cetaceans is used to describe a regular occurrence of an individual whale or small groups of whale in a given area at a given time (Bigg *et al.*1990, and Barros and Wells 1998). Often associated with the term resident is a comparison to "migrant" or "transient" whales (of the same species). When used together there is the assumption that there are marked differences between the two groups which may be evident in feeding (habits, habitat and prey), social behavior, familial organization, and seasonal occurrence.

Potential Effects of a Harvest

The potential effects of a harvest on the seasonal resident group depend on the recruitment mechanism that maintains the group. Three recruitment scenarios are possible: random, social and familial.

Random Recruitment –

Random recruitment occurs when individuals recruit from the migratory population randomly as feeding habitat becomes available along the migration route, find success and return. If the seasonal resident group of gray whales is maintained by random recruitment is can be assumed that it is not self-sustaining (i.e., if it is a "sink" for recruitment from the migratory "source" population, Pulliam1988.). Losses due to harvest could be "replenished" from the migratory population on a fairly short time scale, assuming the larger population has a positive growth rate. In this scenario it can be assume that the maximum annual removal of four gray whales (the average number of gray whales which the Makah may harvest between 1998-2002 – see Chapter 2) from the seasonal resident group is would have negligible impact.

Social Recruitment –

Social recruitment describes the recruitment of whales that are affiliated by age class, or sex. In this scenario, the seasonal resident gray whales could be a group that is skewed by sex and or age class. The impact of harvest on such a group would vary. In theory, a harvest from a group maintained by only male or juvenile animals would have a small to negligible impact. A group maintained by sexually reproducing females, (which mixed with the "migrating population" on the breeding grounds) would represent the most extreme case where the risks imposed by a harvest would be the highest. In the latter case the recovery of the population may be slowed or the population may equilibrate at a lower number than anticipated if the harvest was randomly dispersed among age and sex classes. In this recruitment scenario, the annual removal of four gray whales may be assumed to have a small to negligible impact on the entire eastern North Pacific gray whale stock, and local numbers of the seasonal residents may appear lower (relative to a scenario where no whales were being harvested).

Familial Recruitment-

Familial recruitment describes the recruitment of whales that are member of the same family. If the seasonal resident gray whale group is maintained by familial

recruitment, it is genetically related and self-sustaining (and may be a source for recruitment to the migratory population), losses due to harvest may have a small to severe impact. In this scenario the annual removal of four gray whales could directly effect the number of animals observed and utilizing the area (Appendix C). Impacts to the eastern North Pacific population as a whole could result in a loss of genetic, behavioral and or morphological diversity and the loss of use of a portion of their feeding range.

Discussion and Conclusion

Adverse impacts on the aggregation of the resident gray whales will be dependent on: 1) a high percentage of the maximum number of strikes allowed during the next five years being directed at animals that remain in these waters after May, when most of the population of the eastern North Pacific stock of gray whale continues to migrate to the Bering and Chukchi Sea, and 2) the group of non-migratory animals observed the waters off W.S. and BC representing a discrete population of animals (DeMaster 1998).

The recruitment mechanism that influences or maintains the seasonal resident group of gray whales found in the W.S. waters is not known and thus the effects of a harvest on the seasonal resident group are unknown. Given the mix of whales that return regularly and those seen only one time or through one season (Table 1, page 10) it is likely that the seasonal resident gray whales of Washington State, are maintained by a combination of some or all of the recruitment mechanisms discussed above. If social or familial inherited site fidelity is responsible for the maintenance of a small seasonal resident group, an annual harvest could adversely impact the group. Furthermore, the risk of loosing genetic diversity of the species is greater with familial site fidelity than with randomly established individual site fidelity. If the seasonal resident group is maintained by haphazard or random recruitment from the migratory group, the potential of the seasonal resident group to sustain a harvest is greater.

Genetic research on humpback whales (*Megaptera novaeangliae*) has shown in observed patterns of distribution and migration (not unlike those seen in the gray whale), a marked diversity in the genetic structure of the population (Baker *et al.* 1990, 1994). In this same studies the genetic research revealed maternally reflected fidelity to migratory

destinations. Baker *et al.* (1990) cited further examples of similar maternal fidelity behaviors in Northwest Pacific killer whales (*Orcinus orcas*), in which individuals appear to remain with their natal group, spending much of the year in predictable home ranges. Similar observations have been reported for pilot whales (*Globicephela melas*) where genetic structure may be maintained by maternal fidelity to social groups. These life history traits provide a behavioral mechanism for cultural transmission of migratory destinations, or for inheritance of home ranges and the possible formation of population subdivisions (Baker and Palumbi 1994b).

Successful conservation and management of cetaceans has depended on properly defining "stocks", "distinct population segments", or "management units", implying the existence of a clear level of distinction (i.e., genetic, morphological, or behavioral). Often feeding or breeding grounds define these management units (Clapham 1999). When genetic variation within a species is discontinuous, removals from or habitat disruption of one regional population may eliminate genetic, behavioral, and or morphological variation important to the species as a whole (Hoelzel and Dover 1988). In general a genetic distinction (maintained by familial recruitment) has warranted separate management plans for each genetically distinct group. Finally, genetic sampling and testing of the seasonal resident whales, compared to samples of migratory whales (or whales found in the Bering Sea ecosystem during non-migratory times) could provide insight into the social structure and maintenance of the seasonal resident group [12]. However the most current data related to this revealed that genetic variability between the summer residents and the larger population is low (Steeves *et al.* 1998).

[12] It should be noted that the absence of a detectable genetic difference between two putative populations does not necessarily indicate that the interchange of individuals between them was so large that the two populations should be treated as a single unit for management. In this case morphological, behavioral, geographic and demographic differences should also be considered in evaluating stock structure (Hoelzel and Donovan 1992).

CHAPTER 2
ANALYSIS OF POLICIES AND POLITICAL PROCEEDINGS REGARDING THE SUMMER RESIDENT GRAY WHALES AND THE SUBSISTENCE HARVEST BY THE MAKAH TRIBE

The primary reasons for confusion related to the policies surrounding the issue of the putative seasonal residents and Makah whaling are: 1) the uncertainty regarding the stock identity of the gray whales that are summer residents, and 2) the inconsistencies of related international, domestic and tribal polices. The biological phenomena exhibited by the seasonal residents are recognized in both international (i.e., IWC) and domestic (i.e., ESA, MMPA) conservation policies. These policies suggest that conservation and protection methods are likely to be necessary yet are unclear in their protocol for how to implement them. This chapter looks at polices and related proceedings to identify whether in some way delineation for the seasonal resident gray whale is mandated or necessary, and whether any level of harvest from the summer residents should be allowed.

Players. Policies and the Political Framework

The framework in which the policies surrounding this issue are implemented involves three levels of governing (international, domestic and tribal), each distinct in the manner in which they interact with one another (Figure 3). At one level the U.S. has obligations to the Tribe and the International Whaling Commission (IWC). The Tribe has no obligations to the IWC, and limited obligations to the U.S. This leaves the U.S. having to negotiate plans that harmonize its obligations with both the IWC and the Tribe. Further, the U.S. must also be in compliance with its own federal laws, in this case the Marine Mammal Protection Act, the National Environmental Protection Act, the Endangered Species Act and the National Marine Sanctuary Act.

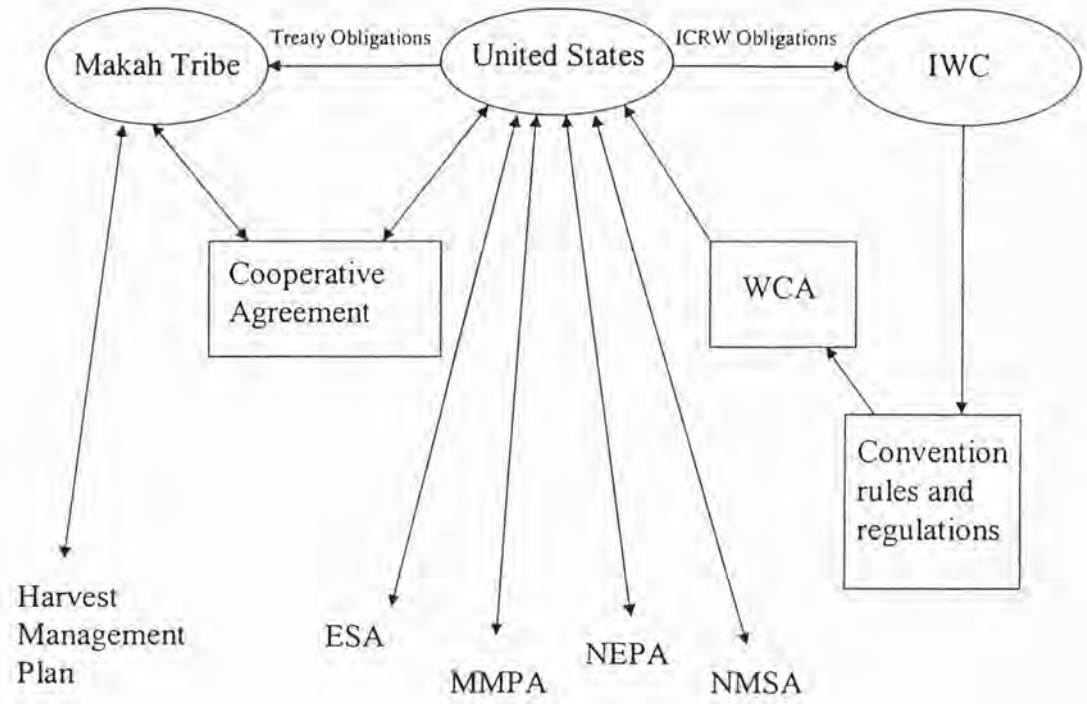

Figure 3. The "political framework".

The International Whaling Commission

In 1937, members party to the second[13] Convention for the Regulation of Whaling recognized the depleted state of the gray whale and implemented an international ban on the taking of gray whales (Henderson 1984 and Rose 1996). The Soviet and the Japanese became party to this agreement in 1946 and 1951, respectively (Reeves 1984), thereby protecting the gray whale from all commercial whaling. In 1946 the ICRW was ratified and amendments to the moratorium on gray whales, created an exception for "when the meat and products of such whales are to be used exclusively for local consumption by the aborigines"[14]. This exception has preserved a quota for aboriginal subsistence gray

[13] The first convention took place in 1931
[14] Article X of the ICRW text

whale takes for the Chukotka natives in Russia, Alaskan natives and now the Makah Tribe, through the present day.

The ratification of the ICRW established an International Whaling Commission[15]. Since their establishment, the IWC has acted as an international regulatory body made up of one voting representative of each contracting government (nation state) [16]. Three permanent committees advise the Commission: Scientific, Technical, and Finance and Administration. The Scientific Committee is charged with reviewing catch data and information related to population status, and recommending research areas, quotas and rates of stock depletion[17]. The Technical Committee drafts amendments for consideration by the Commission and reviews infractions of the IWC rules. The Commission issues recommended whaling regulations in an annual Schedule, which is amended as new information, requests and objections make such actions appropriate. Contracting governments may object to any of the provisions of the Schedule and the amendment (or regulation) will not affect the objecting government.

The IWC's role in the regulation of aboriginal subsistence whaling has been case specific and varies among whale species. The extent of jurisdiction to which the contracting governments have over aboriginal whaling groups and how these groups and the member nations should be held accountable for whaling is unclear. The customary approach[18] of contracting governments, in which aboriginal whaling groups are located, has been for the member nation to request from the IWC, an aboriginal subsistence quota[19]. Paragraph 13 of the IWC Schedule lists the IWC guidelines for aboriginal subsistence takes (Appendix A).

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[15] Article III paragraph 1 of the ICRW text
[16] Article IV paragraph 1 of the ICRW text
[17] IWC Rules of Procedure, Rule 12
[18] The term customary approach refers to the implementation of international law and the "customary law". Customary rules of international law arise from patterns of actions and words of nation-states in the conduct of their relation with each other over time (Kalo *et al.* 1998).
[19] Examples of these requests are found in the "Chairman's report of the IWC annual meetings". In the Chairman's report of the forty-eighth annual meeting see *10.3.2 Request for a catch of five bowhead (Greenland) whales by the Russian Federation, 10.3.3Request for a catch of five gray whales by the U.S.A, 10.3.4 Request by St Vincent*

The IWC recognizes two different stocks of gray whale: the eastern North Pacific stock of gray whale, and the western North Pacific stock of gray whale. The eastern stock, from which the Chukotka and the Makah natives harvest gray whales, is classified [20] by the IWC as a Sustainable Management Stock (SMS)[21] and the western stock as a Protection Stock (PS)[22] . Currently for the eastern North Pacific gray whales a total catch (taken by those whose "traditional, aboriginal and subsistence needs have been recognized[23]") of 620 whales is allowed for the years 1998, 1999, 2000, 2001 and 2002 with a maximum of 140 in any one year[24]. No harvest is authorized for the western North Pacific gray whale stock.

Acknowledgement by the IWC of the seasonal resident gray whales is documented in the proceedings of a meeting of the Aboriginal Subsistence Whaling Sub-

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and the Grenadines for a catch of two humpback whales each season for the seasons 1996/7 to 1998/9, all summarized requests by member nations to the Aboriginal Subsistence Whaling Sub-committee for a quota of whales as per the aboriginal subsistence whaling guidelines.

[20] In 1975/76 the IWC adopted a classification system which categorized species into three categories, Initial Management Stock, Sustained Management Stock and Protected Stock and depending on where the population existed on a theoretical population curve. Table 1 of the current IWC Schedule lists the current classifications of all the whales stocks under IWC review.

[21] Classification of Stocks in the ICRW Schedule - Section 10 (a) A Sustained Management Stock (SMS) is a stock which is not more than 10 per cent of MSY stock level below MSY stock level, and not more than 20 per cent above that level; MSY being determined on the basis of the number of whales. When a stock has remained at a stable level for a considerable period under a regime of approximately constant catches, it shall be classified as a SMS in the absence of any positive evidence that it should be otherwise classified. Commercial whaling shall be permitted on SMS's according to the advice of the Scientific Committee.

[22] Classification of Stocks in the ICRW Schedule - Section 10 (c) A Protection Stock (PS) is a stock, which is below 10 per cent of MSY stock level below MSY stock level. There shall be no commercial whaling on PSs.

[23] The extent to which the Makah Tribes subsistence needs have been "recognized" is debatable. Anti-whaling groups argue that the IWC has not officially recognized the Makah Tribes subsistence and ceremonial needs. At the same time there it is not clear who is authorized to "recognize" these needs – the IWC and or the contracting government in which the aboriginal whaling group is located>

[24] http://ourworld.compuserve.com/homepages/iwcoffice/Catches.htm#Aboriginal

Committee (ASWSC)[25] which took place during the 1996 IWC annual meeting. Specifically the ASWSC noted that it was important to determine whether the proposed take be considered a take from the small Washington summer feeding aggregation, or as a take from the larger segment of the population which migrates to the Bering Sea in the summer. The ASWSC concluded, "the five animals requested would not come from the small summering aggregation"[26]. In 1997 the IWC set an aboriginal subsistence quota based on a joint request by the U.S. and the Russian Federation. A total of 20 gray whales (not to exceed five annually) were authorized to be taken by U.S. aboriginal hunters between 1998 and 2002. The U.S. government has designated the Makah Tribe as the group of aboriginal subsistence hunters to which this quota applies. However, this quota, listed in the current IWC Schedule, makes no distinction for the Washington feeding aggregation.

Because there is not a distinction in the Schedule for the Washington feeding aggregation it is unclear as to how the IWC guidelines of Paragraph 13 should be applied. Current IWC management procedures for commercial whaling address the complexity that may be implied by the existence of the seasonal residents (which might be considered a multi-stock harvest situation), but do not necessarily apply to management of aboriginal whaling. Yet the goals of the Revised Management Procedures (RMP)[27] for commercial whaling only partially adopted by the IWC, do incorporate multi-stock management concerns. Within the RMP, procedures for dealing with uncertainty about stock identity suggests that the catch numbers should in some way relate to the actual number of whales in the area, rather than to the number in some much wider region (Young, N.M. 1992).

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[25] The ASWCS is a sub-committee advising the Scientific Committee. The Scientific Committee advises the Commission. The Commission makes the final decisions about what will be implemented.

[26] IWC, Annex F 1997.

[27] The RMP have been designed to replace the flawed 'New Management Procedures' adopted by the IWC in 1975. The RMP has only been conditionally adopted by the IWC pending further simulation testing and other refinements of 'multi-stock rules' (Young, N.M. 1992).

The Makah Tribe

The Makah Tribe, located on the northwest corner of the Olympic Peninsula in Washington State, has strong whaling traditions embodied in their culture. Evidence of the Makah Tribe's whaling traditions are found in archeological remains (Kirk and Daugherty 1974), their elder's oral history, in accounts of early white settlers (Jewitt 1815, Swan 1870) and in the Treaty of Neah Bay 1855[28]. Archeological evidence of the Makah Tribe's harvest and utilization of whale dates back to between 250 and 450 B.P. (Huelsbeck 1988). Identified whale bones collected at the Ozette Village archaeology site [29], revealed that gray whales were undoubtedly one of the primary whales[30] hunted by Makah whalers (Kirk and Daugherty 1974). Around seventy years ago, concurrent with an overharvest by non-Indian commercial whalers, the Makah Tribe stopped whaling. In May of 1999 the Makah Tribe resumed their traditional whaling practices by taking their first gray whale since the late 1920's.

The extent that the Makah Tribe historically distinguished seasonal resident gray whales from those migrating by is unknown[31]. A review of the available literature

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[28] Article IV of the Treaty of Neah Bay 1855 reads " The right of taking fish and of whaling or sealing at usual and accustomed grounds and stations is further secured to said Indians [being the Makah Tribe]..."

[29] The Ozette Site, known historically as the Ozette Village, covered over 400 years ago by a mud slide, was uncovered during the 1970's (Kirk and Daugherty 1974). The archeological excavation of this site testifies to the central role of whaling by the Makah Tribe before contact with "westerners" (Renker 1996).

[30] Some sources suggest that the humpback whale was the choice and primary target of the Makah. At the Ozette site humpback whales remains were almost as abundant as gray whale remains. Of the bones collected form a late prehistoric layer (Area B70) at the Ozette, humpback whale bones were slightly more common than gray whale bones (Huelsbeck 1988b). Huelsbeck suggests that the humpback whale may have been more common than gray whales prior to commercial hunting 1800s and early 1900s.

[31] In 1998 the author made contact with the Makah Tribal Council and the Makah Whaling Commission, requesting to research tribal traditional whaling management practices. The request included permission to review archived materials from the Makah Cultural and Research Center and to conduct interviews with elders and whaling family members. This request was denied.

revealed some information about hunting times but nothing conclusive. Renker (1996) reported that hunts occurred during both the northbound and southbound migration:

> The whales that "run in the spring" and where known as "spring whales" were said to have red meat because they ate clams and other shellfish they scooped off the rocks. The "winter whale" was considered the best and had a layer of white fat on the outside and red meat underneath (Densmore (1939:49))[32].

Swan (1870), stated that "[The Makah] are more successful in their whaling in some seasons than in others..." Also, when describing seasons Swan noted that "December is called se-hwow-as-put'hl, or the moon in which the se-whow, or chet-a-pook, the California gray whale, makes its appearance". In a description of ceremonial traditions regarding the whale hunt Curtis (1911:16) described the rigors of these practices lasting "from October until the end of the whale season... about the end of June".

The Makah Tribe's whaling traditions, legally preserved in the Treaty of Neah Bay 1855 (Treaty), is unique in that it is the only Native American treaty that specifically preserves rights for whaling. Following the gray whales removal from the U.S. endangered species list the Tribe exercised their whaling right and initiated plans to resume a subsistence harvest. In 1995 the Makah Tribal Council formally requested the U.S. to represent the Tribe in seeking approval from the IWC for an annual aboriginal subsistence quota.

After the IWC approved the joint request from the U.S. and Russia, for an aboriginal subsistence whaling quota for gray whales and bowhead whales (in 1997), the Tribe became party to the Cooperative Agreement. The Cooperative Agreement (Agreement)[33] between the Makah Tribal Council and the NOAA[34] outlines the specific agreements and understandings for requesting a quota for and managing the harvest of

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[32] Taken from Renker (1996).
[33] Officially titled The Agreement between the National Oceanic and Atmospheric Administration and the Makah Tribal Council.
[34] NOAA is the Federal Agency within the U.S. that has responsibility for the management and programs concerning gray whales.

gray whales. Further a resolution[35] was signed to which was attached the Management Plan for Makah Treaty Gray Whale Hunting for the Years 1998-2002 ("Management Plan" or "Plan"). The Plan sets forth the Makah Tribe's management intent and applicable Tribal regulations to govern Treaty, ceremonial and subsistence whaling rights during the period 1998 through 2002. Section IV of the Plan titled "Permits", paragraph "A", states that "whaling permits shall be issued with the intent of targeting migrating whales". This implies that whales seen in the Makah U.A. between June 30 and October 31,[36] are not migrating and will not be hunted.

The United States

Obligations to the IWC

The Untied States is a signatory to the ICRW. International conventions, like the ICRW are considered a source of international law[37], and act like a treaty, analogous to contracts between individuals in a legal domestic system (Kalo *et al.* 1994). Such conventions attempt to provide legal rules or regulations of certain activities, in this case, whaling. As a signatory to the ICRW the U.S. is bound to uphold the rules and regulations determined by the ICRW and Commission, unless they explicitly object.

As a method for the domestic implementation of the agreements of the ICRW, the Untied States Congress passed the Whaling Convention Act of 1949 (WCA)[38], which outlines methods for upholding agreements to the IWC. Section 916b of WCA sets forth guidelines for the rejection or acceptance by the U.S. Government of IWC regulations,

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[35] Resolution number 67-98 of the Makah Tribal Council enacted 1-30-98

[36] In a letter to Mr. Johnson, Jr., Chairman of the Makah Tribal Council from U.S. Secretary of Commerce James Baker, in reference to the above mention section of the Management Plan, it is stated that "NOAA understands that this statement of intent indicates that the MWC (Makah Whaling Commission) will not issue permits before November 1 or after June 30, unless consulting with NMFS..."

[37] Kalo *et al.* (1994), defines international law as law that regulates the behavior of nation states in their relations with one another. It is a primitive legal system, one that has no legislature or executive and no compulsory-jurisdiction court, yet provides structure for the international community of nation states.

[38] 16 U.S.C. 916 *et seq.*

reports and recommendations. The Secretary of State with concurrence of the Secretary of Commerce is responsible for the presentation or withdrawal of objections to the regulations and amendments to the Schedule. Further the Secretary is authorized to receive reports, requests, recommendations and other communications of the Commission and to act thereon either directly or by reference to the appropriate authority.

Obligations to the Makah Tribe

The Treaty of Neah Bay 1855, is a contract between the Makah Tribe and the United States government. Such treaties recognize the Native American tribes as sovereign nations and preserve rights explicit within the treaty, so long as they are not voluntarily ceded by the tribe or are extinguished by U.S. Congress[39] (Getches *et al.* 1998). Views as to whether the whaling rights of the Tribe have been superceded by latter agreements differ[40]. Yet the U.S. takes the stance that no Act of Congress (including the WCA and the MMPA) has explicitly abrogated the Treaty or the Makah Tribe's right to conduct whaling, nor has anything in the laws and legislative history ever mentioned the Treaty of Neah Bay (EA 1997).

Additional and more specific obligations are contracted in the Cooperative Agreement. The purposes of the Agreement are: 1) to recognize the importance of whaling to the Makah's historical culture, 2) to protect the gray whale and promote scientific knowledge about it, and 3) to effectuate the purposes of the Treaty of Neah Bay, and of U.S. Federal Laws[41], through cooperation between the Makah Tribal Council and NOAA. The Agreement makes no mention of or provision for the seasonal resident gray whales that occur in the W.S. waters.

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[39] The U.S. Congress had plenary power over these tribal treaties. Abrogation and changes to treaty agreements must be explicitly stated as so (Getches et al.1998).

[40] Some groups opposed to the resumption of whaling by the Makah, believe that the ICRW and WCA implementing the ICRW supercedes any legal obligations the US may have under the 1855 Treaty of Neah Bay (HIS 1997).

[41] Opening Paragraph of the Cooperative Agreement.

U.S. National Obligations

The primary U.S. domestic policies related to the seasonal resident gray whales include the Marine Mammal Protection Act, the Endangered Species Act, the National Environmental Protection Act and the National Marine Sanctuary Act.

Marine Mammal Protection Act

Under the Marine Mammal Protection Act of 1972, amended in 1994, species and population stocks which have been in or are in danger of depletion as a result of man's activities are not to be permitted to be diminished beyond the point at which they cease to be a functioning element of the ecosystem in which they are a part [42]. This act focuses it efforts and mandates on the protection of essential habitat, including rookeries, mating grounds, and areas of similar significance[43] (i.e., feeding grounds). The goal of these mandates is to obtain and or maintain stocks at an optimum sustainable population (OSP)[44] level, keeping in mind the carrying capacity of the habitat.

The seasonal resident gray whales may qualify for special protection if they are considered to "be a functioning element of the ecosystem in which they are part ", yet within the MMPA this situation is not further defined. The significance of the seasonal residents may be assessed when more is known about the biological maintenance of the group (Chapter 1). If there is insufficient dispersal between the migratory population and the putative seasonal residents, unmonitored exploitation coupled with their inappropriate pooling for management could result in failure to meet MMPA objectives (Wade and Angliss 1997).

Under the MMPA there are allowances for the setting of specific regulations with respect to the taking and importing of animals from each species of marine mammals, (including regulations on the taking and importing of individuals from within the

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[42] 16 U.S.C. § 1362 (1).
[43] 16 U.S.C. § 1362 (2).
[44] The range of estimates between MNPL (maximum net productivity level) and K (denoting a population at carrying capacity) defines the optimum sustainable population (OSP) (Gerrodette and DeMaster, 1991). For marine mammal populations OSP is considered to be approximately 60% of K, meaning that the OSP ranges from 60% of K to K.

population stocks), to insure that OSP is achieved[45]. Restrictions could be set on: 1) number, 2) age, sex, size or and combination of such, 3) the season or period of time within which animals may be taken, and 4) the manner and locations in which animals may be taken.

The Makah Tribe is exempt from the provisions of the MMPA[46], except when it has been determined that any species or stock of marine mammal "subject to taking by Indians, Aleuts or Eskimos to be depleted" in which case regulations upon the taking of such marine mammals may be implemented. Furthermore the whaling rights of the Treaty of Neah Bay are exempt from the provisions of the MMPA[47]. The provisions of the MMPA are intended to be in addition to, and not in contravention of, the provisions of any existing international treaty (like the ICRW), convention or agreement of any statute implementing the same, which may otherwise apply to taking of marine mammals[48].

Endangered Species Act

The purposes of the Endangered Species Act of 1973 are to provide a means, where by the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered and threatened species, and to take such steps as may be appropriate to achieve the purposes of specific treaties and conventions[49]. Under the ESA "species" is defined to include any subspecies and any distinct population segment of any species of vertebrate fish or wildlife that interbreeds when mature. The purpose of such definition is to direct management efforts to taxonomic levels below that of a species to ensure that populations that are uniquely adapted to given areas are not irreversibly reduced by harvest or habitat

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[45] 16 U.S.C. § 1373 (103)(a)
[46] 16 U.S.C. § 1371 (101)(b)
[47] Provisions read "Nothing in this alters or is intended to alter any treaty between the United States and one or more Indian tribes" (16 U.S.C. § 1361 note. Section 14 of Pub. L. 103-238, enacted April 30, 1994 has not yet been codified).
[48] 16 U.S.C. § 1383 (113)
[49] The treaties and conventions referred to in this act are listed in 16 U.S.C. §§ 1531.2(a)(4)

destruction (Dizon *et al.* 1992). However there is no working definition of intraspecific taxa, and no direction to what taxonomic levels conservation efforts are to be directed.

A distinct population segment (as mentioned above in the definition of species), or evolutionary unit (EU)[50], is a group of organisms that represents a segment of biological diversity that shares a common evolutionary lineage and contains the potential for a unique evolutionary future (NRC, 1995). The NRC (1995) recommended that estimates of distinctiveness be based on a combination of genetic, molecular, behavioral, morphological, or ecological characteristics that result in a level of isolation.

In 1994 the eastern North Pacific stock of gray whale was removed from the endangered species list, and their population is thought to be at or near pre-exploitation numbers. Thus it is generally considered that the ESA does not apply in this case (EA 1997). For the aggregation of summer resident gray whales to be granted protection under the ESA they would have to: 1) exhibit a level of distinction resulting in isolation, 2) be in danger of extinction or likely to become extinct within the foreseeable future[51], and 3) would have to be formally listed under the ESA as threatened or endangered. The site fidelity exhibited by the seasonal residents suggests that the summer resident group may in some way be adapted (or have more success) in feeding along the coastline of Washington State more than the Bering sea ecosystem (see chapter 1). However it is not clear to what extent loses due to subsistence hunting would be offset by immigration from the component of the population that migrates to the Bering Sea.

National Environmental Protection Act[52]

The National Environmental Policy Act of 1969 established national environmental policy and goals for the protection, maintenance, and enhancement of the environment. NEPA requires federal agencies to examine the environmental

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[50] The NRC Committee on Scientific Issues in the Endangered Species Act created the concept of an evolutionary unit (EU), for identifying distinct population segments as mandated by the ESA.

[51] 16 U.S.C. § 1533 (b)(1B)(ii)

consequences of major proposed actions, such as building a new facility (or in this case resumption of aboriginal whaling), and to conduct a decision-making process that incorporates public input. NEPA requires federal agencies to use a systematic process to provide environmental impact information to federal, state, local and Indian Nation officials as well as to citizens before decisions are made to take major actions that may significantly affect the environment.

If the proposed action is not granted a categorical exclusion[53], the appropriate Federal Agency (in this case NMFS, NOAA) makes an initial determination as to whether an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) is required. If impacts appear to be significant, an EA is prepared in order to study the impacts of the proposed action, alternatives to the action, and whether the action will create an environmental impact significant enough to warrant an EIS. If the EA shows the proposed action would not significantly affect the environment, a Finding of No Significant Impact (FONSI) is issued. On the other hand, if the EA shows the action has the potential to significantly affect the environment, an EIS must be prepared.

Upon the Makah's indication that they wished to resume whaling, an EA was prepared. Within this assessment NMFS estimates that there are approximately 35 to 50 gray whales that summer off Vancouver Island each year and roughly the same number that spend summers on the U.S. side. In the EA, NMFS also reported that an estimated 60% of the Vancouver whales return year after year, and that the remaining 40% only come one year. It was further concluded that, if any of the whales landed by the Makah are summer residents, they would likely to be replaced by the new whales. In considering the possible impact on the seasonal residents, NMFS concluded that no level of harvest anticipated by the Makah Tribe is likely to have a serious impact.

There is a level of uncertainty regarding the potential impacts of a harvest to the seasonal resident group (see Chapter 1). More recent research has revealed that the

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[52] The following synthesis on the NEPA are experts from the Department of Energy's "tools' web site www.tis-nt.eh.doe.gov/nepa/tools/policy2.htm

[53] If the proposed action meets certain criteria that have previously been determined as having no significant environmental impact, the project may qualify for a categorical

actual number of these seasonal residents may number in the hundreds and the extent of their exchange may range from Northern California to southeast Alaska (Calambokidis and Quan 1999). Impacts of a harvest on the seasonal resident group will depend on the size of the group (Appendix C) and the recruitment mechanisms that maintain the group.

National Marine Sanctuary Act

The National Marine Sanctuary Act authorizes the Secretary of Commerce to designate discrete areas of the marine environment having special national significance as national marine sanctuaries. The main focus is to ensure comprehensive management, conservation and protection of their recreational, ecological, historical, research, educational, or aesthetic resources and quality. The implementation[54] and application[55] of this act are applied in accordance with generally recognized principles of international law, and with the treaties, conventions, and other agreements to which the United States is a party.

In 1993, under the National Marine Sanctuary Act, the Olympic Coast National Marine Sanctuary was established, in which is located the Makah Tribe U.A. An EIS[56] was prepared during the creation of the sanctuary. The EIS reported that annually, ten to fifteen individuals remain as summer residents [within the boundaries of the sanctuary][57]. The EIS specifically noted that the Act does not abrogate the coastal Tribes' treaty fishing and hunting rights. Further specifications within the EIS[58] stated that the taking any marine mammals are prohibited except "...pursuant to any Indian treaty with an Indian tribe to which the United States is a party, provided that the Indian treaty right is exercised in accordance with the MMPA, ESA and MBTA..." As long as the

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exclusion. A categorical exclusion exempts the project from further environmental evaluation under NEPA.

[54] Id. Sec 304

[55] Id. Sec 305

[56] United States Department of Commerce, Final Environmental Impact Statement and Management Plan for the Olympic Coast National Marine Sanctuary. Prepared by the Sanctuaries and Reserves Division Office of Ocean and Coastal Resource Management, NOS, NOAA, Sliver Springs MD

[57] Vol. 1 section II-82 of the EIS

[58] Subpart O Olympic Coast National Marine

classification of the seasonal resident group remains uncertain and they are not granted particular status under the MMPA or the ESA, the NMSA has not bearing on the situation.

Conclusion

The international, domestic and tribal policies and political proceedings regarding the need to avoid, protect, and conserve the seasonal resident gray whale, in respect to aboriginal whaling by the Makah Tribe, are neither harmonious or clear. In the IWC Schedule there are no specific provisions for the summer resident gray whales and therefore no mandate for specific avoidance and for the application of Paragraph 13. The Makah's Management Plan provides that whaling permits shall be issued with the intent of targeting migrating whales, however "there is no guarantee that one of the summer residents might be struck inadvertently" (EA 1997). The U.S. findings in the EA regarding the potential impacts on the seasonal resident whales are that there seems to be little need to delineate seasonal residents[59] as a separate stock. The extent to which seasonal resident gray whales need additional protection under the U.S. MMPA and ESA is unclear. Until there is a comprehensible interpretation of what constitutes a "significant functioning element in the ecosystem", or clearer information on the biological mechanism that maintains the seasonal resident group, domestic mandates seemingly do not apply.

There is a fundamental assumption in the current agreements among the Makah, the U.S. and the IWC regarding the seasonal resident gray whale group that the Makah Tribe intends to target only migratory whales (as opposed to seasonal residents). If there is a take of seasonal resident gray whales the impact to these current agreements could be substantial. In the worst case scenario, the IWC would not reissue an aboriginal subsistence whaling quota to the U.S. and the Makah Tribe, asserting their treaty rights, would continue to take whales. Politically such a scenario would brand the U.S. as a

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[59] The EA goes on to conclude that "... if a summer resident is taken, or in the worst case if all the whales landed by the Makah were summer residents, new whales are likely to appear and take their places".

"pirate-whaling" nation resulting in a loss of credibility as a proactive and conservation minded anti-commercial whaling nation, as well as lessening the international community's willingness to discourage "pirate-whaling" by other nations. On the other hand the U.S. Congress could assert its legislative authority and abrogate the Makah Tribes treaty rights. In this case it is likely that the U.S. would undergo a domestic debate over Native American rights.

CHAPTER 3

MANAGEMENT IMPLICATIONS AND OPTIONS FOR THE SUMMER RESIDENT GRAY WHALES OF WASHINGTON STATE

Currently the seasonal resident group of gray whales is not managed as a distinct group. The terms "seasonal resident" and "site fidelity", which are used to describe this putative group of gray whales, are biological phenomena that are not defined for management purposes, yet may warrant consideration for conservation and management of human induced mortality (incidental catch, aboriginal hunting, pollution and habitat degradation). Some of the policies surrounding this issue suggest that the avoidance of the seasonal residents is necessary, while others suggest that there is no need for delineation (see chapter 2). Regardless, the resumption of aboriginal whaling by the Makah has resulted in management strategies intent on avoidance of the seasonal resident gray whale.

Current management strategies take the form of both seasonal and spatial delineation. In a position statement[60] (Ziontz 1997), the Makah Tribe specified that area restrictions are to be designed to insure the take of only migrating whales and not seasonal resident whales. The Makah Tribe and National Marine Fisheries Service (NMFS), in part of the Cooperative Agreement, established the Bonilla/Tatoosh line (Figure 2, page 9) which prohibits the taking of gray whales in the Strait of Juan de Fuca (SJF). Furthermore, the Makah Management Plan specifies that whaling permits will be issued with the intent of targeting only migrating whales thereby restricting the hunt to winter and spring months[61].

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[60] The Makah Tribe and Whaling: A position Statement, released in 1997, paragraph 10 sec d., number 2 "Area restrictions designed to insure we take only migrating whales and not resident whales;"

[61] At specific intervals during these months, gray whales are seen migrating through Washington waters and resident whales are less likely to be in the area at these times.

These current management strategies remain problematic. Neither the spatial or seasonal delineation insures that only migratory animals will be taken and, there are no methods or provisions in place to monitor whether struck and landed whales are seasonal residents or migratory animals. Yet in all scenarios (see Chapter 1), it is likely the seasonal residents may be able to sustain a level of take, and complete avoidance may be both unavoidable and unnecessary. This chapter considers two approaches to management for this putative population: 1) a complete avoidance and 2) an allowance for a monitored harvest from the seasonal resident group.

Biological Implications in Relation to Management Needs

Biological implications in relation to management needs depends highly on the biological mechanism that maintain the seasonal resident group (see Chapter 1) and the risks associated with harvesting under those conditions (Figure 4). If random recruitment is responsible for the maintenance of the group, it can be assumed that animals taken from the summer residents will be replaced from the migratory animals. For conditions of random recruitment low (where the population has a positive growth rate) the risks are low and the need for separate management is assumed low. If social recruitment maintains the seasonal residents the risks associated with a harvest may be greater than conditions under random recruitment. For conditions of social recruitment, management would at the very least require that the level of removal of the seasonal residents be monitored, with particular attention to the sex and age class of harvested individuals. If the seasonal residents are maintained by familial recruitment, the risks of an unmonitored take are the highest. Under these conditions the management protocols may include the employment of measures to ensure that removal rates do not exceed replacement rates.

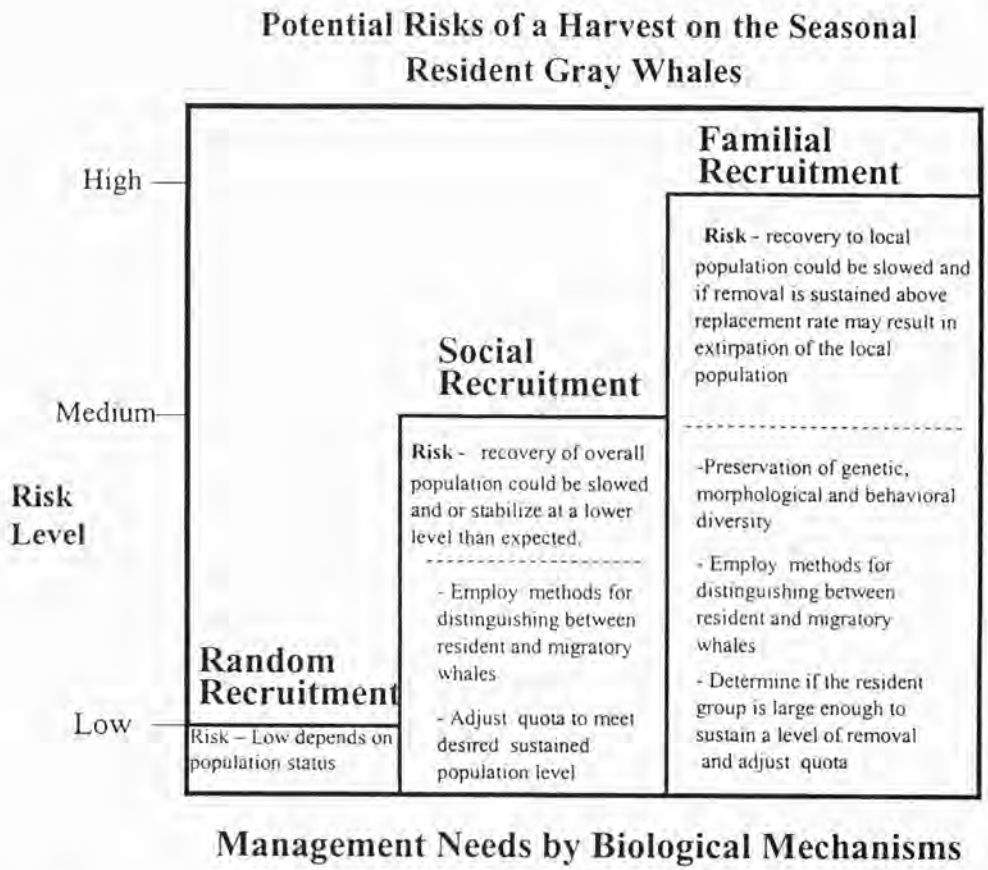

Figure 4.

Management for Avoidance

Management objectives aimed at complete avoidance of the seasonal residents would employ methods of seasonal, spatial and behavior delineation in relation to the timing of migratory movements (EA 1997, DeMaster 1998). Extensive research on gray whale migration movements and behaviors has revealed distinct migration patterns (Braham 1984, Poole 1984, Swartz 1986). The most prominent feature of both the northbound and southbound migration is that they occur in two phases separated by age/sex class. In the northbound migration adults and immature animals are seen first, followed in one or more months by mother/calf pairs. In the southbound migration, near term pregnant females are first to migrate followed by adults and then immature animals.

The migration has been described as taking place within a "migratory corridor", defined by a distinct spatial utilization of nearshore habitat through which the migration occurs. Research on whales moving northbound along the California coast revealed utilization of an "offshore corridor" which, in certain areas, ranged from 800m to 3.2km and in other areas out to 12km, where adults were observed in the outside and juveniles the nearshore portions of the offshore corridor (Poole 1984). In the same area mother/calf pairs, seen in the second phase of the migration were observed traveling primarily within 200m to 400m off shore. In Alaska, observations of the northbound migration found that most of the gray whales followed the coast, staying within 2 km of shore, except when crossing major bays, straits and inlets (Braham 1984). Aerial surveys, during the southbound migration, off the Washington Coast found gray whales 5.5km to 47 km offshore (Shelden *et al.* 1999a, 1999b)[62]. Shelden *et al.* (1999a) concluded that gray whales are widely dispersed across the outer continental shelf of W.S. during both migratory and non-migratory periods.

The existing management regime employs both spatial and seasonal delineation as a means of targeting only migrating whales for harvest. However, both the time and location of the harvest restrictions may not be adequate if the goal is complete avoidance. For the existing plans, with the goal of avoidance, to be effective there would need to be an expansion of both the spatial and seasonal delineation as well as additions of a behavioral delineation and methods for monitoring removal for any accidental takes of residents.

Spatial Delineation

The Bonilla/Tatoosh line (the Line)(Figure 2, page 9) marks the spatial restrictions currently in place. As per the Cooperative Agreement, hunting is to take place west of the Line and in the open waters of the Pacific Ocean[63]. However, seasonal resident whales have been observed moving among and between areas both inside the

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[62] Migratory timing cannot be confirmed by this study as there are too few whales seen during the flights.

[63] Section II "Co-management Agreement" in sub section 3(e) of the Cooperative Agreement.

Strait of Juan de Fuca which lies east of the Line and in the open waters of Pacific Ocean and along the outer coastline west of the Line. In 1996, 1997 and 1998, 36%, 43%, and 18% (respectively) of whales that were sighted in the SJF region (east of the Line) were also seen in the OC region (west of the Line) within the same year. The spatial restrictions imposed by the Bonilla/Tatoosh line will only protect the seasonal resident whales so long as they remain on the east side of the line.

For spatial restrictions to aid in complete avoidance the restricted area would have to cover more accurately the area utilized by the seasonal residents. An effective delineation would expand the current spatial restrictions to include the outer coast to a specified distance farther off shore to the "migratory corridor". Problems associated with such an expansion is that the specific boundaries of the migratory corridor are unknown, and it is likely that they may change from year to year (Mate and Poff 1999). Also, as the hunters go farther off shore to hunt, safety concerns become a larger issue.

Seasonal Delineation

Given the well-documented and predictable migration patterns of the eastern North Pacific gray whale, it may be possible to identify seasonal time periods (i.e., by month) during which migration is underway in the W.S. waters and migrants can be targeted. Gray whales seen outside the identified time period would then be considered summer residents.

Along the Oregon coast the northbound/spring migration occurs between mid-February and late May, and exhibits two peaks (which is consistent with the segregated phases of migration mentioned earlier) (Herzing and Mate 1984). The first peak (consisting mostly of adults and immature animals) occurs from early March to the end of April. The second peak (consisting mostly of mother and calf pairs) occurs from late April through May. The southbound migration occurs from early December to mid-February.

Darling (1984) reported finding similar to Herzing and Mate (1984) for migration timings off the coast of Vancouver Island, BC. For the northbound migration, animals were observed from February, peaking in last two weeks of March, through June. During

this time summer resident gray whales observed in the waters off of Vancouver Island were seen as early as the first two weeks of April. The southbound migration occurs at from late November to late January, peaking during the last two weeks in December. During the southbound migration time the latest identified summer resident observed in the waters off of Vancouver Island was seen in mid-December.

Currently November 1 through June 30[64] marks the gray whale hunting season for the Makah Tribe. The arrival of the seasonal residents and the residence time of the seasonal residents is likely to overlap with both the northbound and southbound migration time. On the W.S. outer coast (in particular Grays Harbor, south of the Makah U.A.) seasonal residents have been identified as early as March. Little to no information exists (due largely to an absence of data collection during these time periods) on the gray whales seen in the Makah U.A between the months of March and June (during the spring or northbound migration). In 1998 data collection in the months of October and November (just prior to the southbound migration) revealed that 39% and 25% (respectively) of the whales seen in the OC and SJF regions were seen also in previous years. Of the whales seen in October, 92% had been seen more than one day within 1998 and 39% had been seen prior to the first of October. Of the whales seen in November, 75% had been seen more than one day within 1998 and 63% had been seen prior to the first of November.

For the seasonal delineation to be more effective, restrictions that allowed hunting for the months of December through March would likely increase the chance that only migratory whales will be taken. Further hunting during peak migration times (i.e., the middle of December and the end of March) would also increase the chance of taking a migrant. Though, without methods for distinguishing between migratory animals and

[64] In a letter to Mr. Johnson, Jr., Chairman of the Makah Tribal Council from U.S. Secretary of Commerce James Baker, in reference to the above mention section of the Management Plan, it is stated that "NOAA understands that this statement of intent indicates that the MWC (Makah Whaling Commission) will not issue permits before November 1 or after June 30, unless consulting with NMFS…".

seasonal residents there is not any way to ensure that only migratory whale are going to be taken.

Behavioral Delineation

Feeding is the primary behavior of seasonal residents seen in the waters of W.S. and the adjacent waters (BC). Gray whales have been observed engaged in a variety of feeding techniques: benthic suction, engulfing and skimming (Darling 1998). Other observations have revealed that migrating whales are found farther off shore, and appear to be engaged in distinct traveling behavior, as opposed to a milling or feeding behavior (DeMaster 1998, Calambokidis pers. com.) that is observed in the seasonal residents (Darling 1998). Thus targeting animals that are observed clearly engaged in a traveling behavior may also aid in identification of migratory animals.

Monitoring

Photographic Identification

Photographic identification research, conducted in the Washington State waters since 1984, has resulted in the development of photographic catalog (Calambokidis et al. 1994) that continues to expand as old whales are re-sighted and new whales enter the area. Currently this catalog contains photographs of over 200 individual gray whales seen in the W.S. waters. For photographic identification of gray whales, both left and right sides of the dorsal region around the dorsal hump are photographed (Figure 5). When possible the ventral surface of the flukes are photographed, though this method has not been as reliable as the sides of the whales because they do not always raise their flukes out of the water. Markings used to distinguish whales included patterns of pigmentation of the skin, mottling, scarring, and attached barnacles, which vary among individuals.

Given the nature of photo-ID research, the photo catalog does not contain photographs of every seasonal resident whale and is likely to contain some photos of migrant whales. Yet a comparison of photographs of struck or landed whales, to the catalog could provide a method for detecting the removal of seasonal resident gray

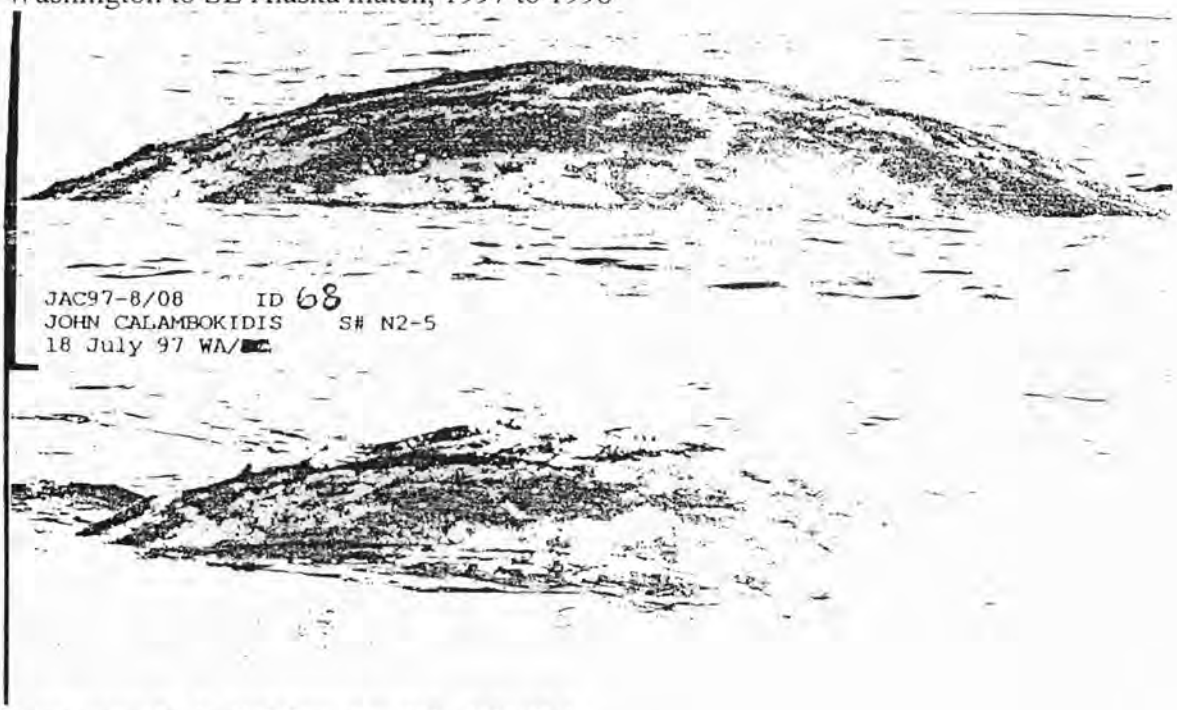
whales. Matching photographs of dead whales to the existing-catalog has been successful (Calambokidis pers. com.).

Genetic Comparison

Genetic techniques using DNA fingerprint analysis have proven to be very effective in distinguishing stock structure of cetaceans (Baker and Palumbi 1994a). The evidence obtained from genetic methods is considered by resource managers as the most unequivocal for differentiating species and their intraspecific structure (Dizon *et al.* 1992). If a genetic distinction exists between the summer residents and the population segment that summers in the Arctic, a comparison of tissues collected from landed whales to tissues collected from seasonal residents may provide an effective means of monitoring.

Further, recent advances in genetic analyses allow for the identification of individual animals. Biopsy samples have been collected from 20-40 individual summer residents for the assessment of contaminant loads (Gearin pers.com). The skin from these samples can be used to provide DNA samples for individual recognition. Therefore, in addition to a photographic comparison, it should also be possible to identify harvested animals from skin samples of the harvested whales with previously collected skin samples from known summer residents.

Washington to SE Alaska match, 1997 to 1998



Vancouver Is. to California match, July-Oct 1998

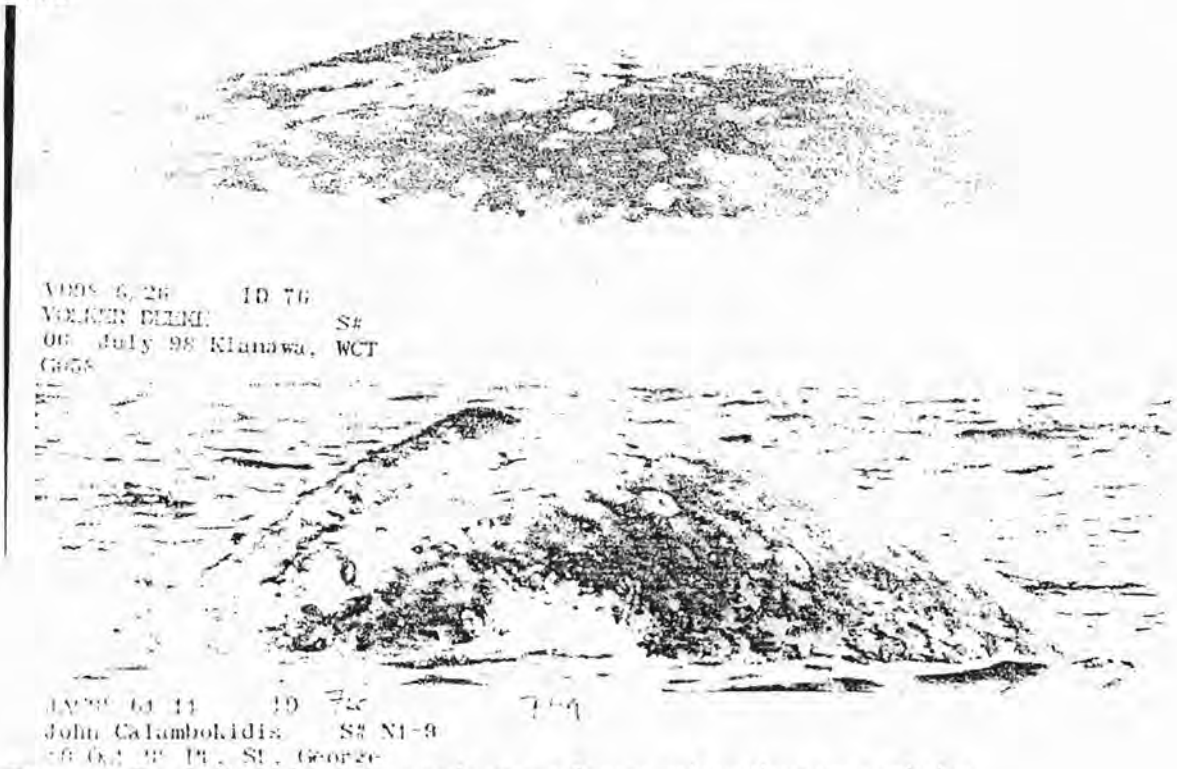


Figure 5. Examples of matches and range of seasonal resident gray whales

Allowance of a Managed Harvest from the Summer Residents

In all scenarios it is likely that the seasonal resident group can sustain some level of take. An alternative or complimentary management approach, to the spatial and seasonal delineation, would be to estimate whether this aggregation is large enough to sustain some level of removal, and to allow for a harvest of seasonal residents if the aggregation is large enough to sustain removal. The IWC Schedule and MMPA each contain guidelines by which a quota could be developed. The application of either quota system would employ the assumption that the seasonal resident group is a distinct population. Removal estimates ("quota", "catch limits" or "PBR") would be made in relation to the number of animals in the putative seasonal resident group.

International Whaling Commission Guidelines

Paragraph 13 of the IWC schedule (Appendix A) states the guidelines for setting catch limits for aboriginal subsistence whaling. These guidelines employ the theory of MSY, which assumes that there is a level of harvest where the number of whales taken from a harvestable population is equally balanced by the number of new recruits into the harvestable population. The guidelines specify that for stocks at or above MSY level, total removals should not exceed 90 per cent of MSY. For stocks below the MSY level but above a certain minimum level[65], catches are to be permitted so long as they are set at levels, which will allow whale stocks to move to the MSY level. In a population for which logistical growth is assumed, as well as the harvest being random with respect to age and sex, MSY is thought to occur at 50% of carrying capacity (K) (Figure 6).

Unfortunately, the IWC has not established species specific or general population levels below which removals by subsistence hunters would not be allowed. To some extent, this is because there are inadequate data to evaluate the extent to which "smallness" in population size alone will prevent a population from recovering and the

[65] This currently is an unspecified level, and is decided upon by the Commission.

extent to which stochastic (unpredictable) environmental events, when added to the problem of "smallness" will prevent recovery (DeMaster pers. com.).

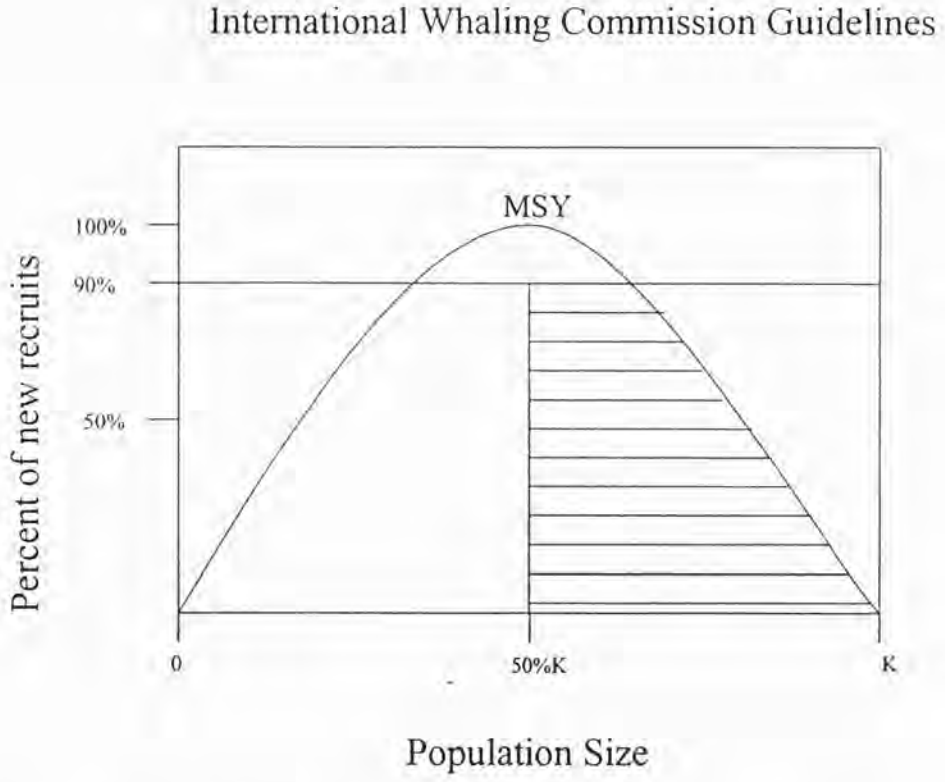


Figure 6. For a population where logistical growth is assumed the number of recruits are at the greatest when the population is at 50% of K. The shaded area represents acceptable levels of harvest, as per the IWC Schedule Paragraph 13 (Appendix A), for a harvestable population at or above MSY. For harvestable populations considered below MSY the level of removal must be less that the number of recruits.

Table 2. Examples of catch limits as per the IWC Paragraph 13 Guidelines. These examples and catch limits assume that the population is at or above MSY.

K	MSY	Catch Limit
200	2	1.8
400	4	3.6
600	6	5.4

Marine Mammal Protection Act Guidelines

Objectives (goals) of the MMPA specify that "population stocks should not be permitted to diminish beyond the point at which they cease to be a functioning element in the ecosystem of which they are part" and " it should be the goal to obtain an optimum and sustainable population keeping in mind the carrying capacity of the habitat." Under the MMPA, human-caused mortality is regulated through the calculation and implementation of Potential Biological Removal (PBR) levels. PBR is defined as "the maximum number of animals, not including natural moralities, that may be removed from a marine mammal stock while allowing the stock to reach or maintain its optimum sustainable population". Optimum sustainable population (OSP) is defined (with respect to any population stock) as the number of animals which will result in the maximum productivity of the population or the species or in other words which will maintain populations above their maximum net productivity level (MNPL)[66] (Wade and Angliss 1997). Thus the range of estimates between MNPL and K (denoting a population at carrying capacity) defines OSP (Gerrodette and DeMaster, 1990) (Figure 7).

[66] 50 C.F.R. 216.3

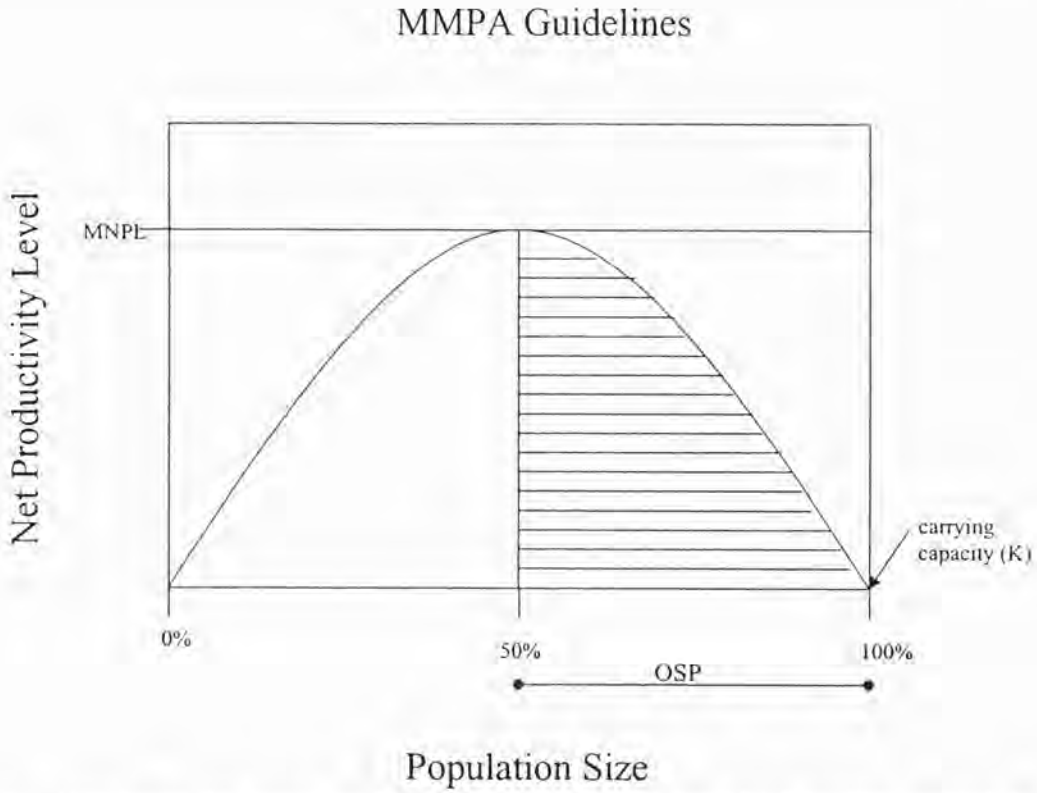


Figure 7. Similar to the theory of MSY, for a population for which logistic growth is assumed the MNPL occurs at 50% of K. Thus under such condition OSP, represented by the shaded area, would be considered to range from 50% of K to K.

The equation used to calculate PBR is:

$$PBR=N_{min}*0.5R_{max}*F_r$$

N_{min} – is the minimum population estimate of the stock

R_{max} - is the theoretical or estimated net productivity rate, which is the annual per captia rate of increase in stock resulting from addition due to reproduction, less the losses due to mortality: generally 0.04 is used for cetaceans and .12 for pinnipeds and sea otters

F_r – is a recovery factor: 0.1 for stocks listed as endangered, 0.5 for stocks that are listed as threatened or depleted or are of unknown status and 1.0 for stock known to be within OSP.

Table 3. Examples of PBR estimates as per the guidelines of the MMPA. (Rmax=0.04)

Nmin	Fr	PBR
200	0.5	2
	1	4
400	0.5	4
	1	8
600	0.5	6
	1	12

Discussion and Conclusions

Current management regimes aimed at the protection or avoidance of the seasonal resident group may not ensure that only migratory whales are taken. Changes to the existing regime would require expanding time and space restrictions as well as the employment of behavioral delineation and methods of monitoring through the use of photographic and or genetic comparison. For the changes to be effective they would ultimately restrict the hunt to winter months and farther off-shore in a specified "migratory corridor" where only after an extended period of observation, whales exhibiting a distinct behavior of migrating could be targeted. Restrictions such as these only add to the already inherent dangers of whaling and still would not "guarantee that one of the summer residents would not be struck inadvertently[67]."

It is likely that the summer residents, whether maintained by random, social or familial recruitment, may be able to sustain some level of removal. If this is the case complete avoidance of the summer resident gray whale is unnecessary. Under the IWC Paragraph 13 (Appendix A) guidelines and the MMPA PBR guidelines for a population as small as 200 removal levels of 1.8 to 4 animals would be acceptable. The

implementation of a "summer resident quota" would provide a direct approach to management without compromising the Makah Tribal hunt assuming: 1) that minimum population requirements are met, 2) the harvest is random with respect to age and sex and 3) all struck and lost animals are considered part of the quota. Further the Makah Tribe may benefit, as the restrictions imposed to delineate for the seasonal residents would not always be necessary. Hunting during the late spring, summer and early fall, when sea and weather conditions are likely to be better, could be permitted.

Recommendations

For the Makah Tribe to meet their subsistence and ceremonial needs, an intentional or incidental harvest from the seasonal residents may be unavoidable. In most cases it is likely that the residents may be able to sustain a level of removal and the complete avoidance of the seasonal residents may be unnecessary. Until more information is known about this aggregation, management plans and policies should take a precautionary approach. The recommended changes to the existing management plans are:

- *Adopt precautionary assumption that the seasonal residents are a distinct population segment.* This is a conservative approach. Under the most extreme scenario, where the seasonal residents are maintained by familial recruitment, the management as a distinct population segment would be appropriate. If the seasonal resident group were maintained by random recruitment, management as a distinct population segment would not seem necessary, yet the application is not likely to harm the group.

- *Test viability of current criteria for avoiding take of seasonal residents through collection of data from struck and landed whales to determine if they are seasonal residents or migrants.* Currently the only way to test the current criteria is through matching photographs of struck and landed gray whales to the existing catalogs or

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[67] EA at 29 (AR151)

by matching DNA fingerprint analysis of harvested animals to previously sampled summer resident animals.

- *Estimate whether this aggregation is large enough to sustain some level of removal.* Estimates of the current population size (i.e., N_{min}), as well as other population parameters, such as growth rates, are required in order to determine if the population is large enough to sustain removal. Under the MMPA, the minimum population estimates: 1) are based on the best available scientific information on abundance, incorporating the precision and variability associated with such information and 2) provides reasonable assurance that the stock size is equal to or greater than the estimate. For the IWC the Commission, on advice of the Scientific Committee, establishes as far as possible: 1) a minimum stock level for each stock below which whales shall not be taken, and (b) a rate of increase towards the MSY level for each stock.

- *Allow for some take of seasonal residents (a "summer resident quota") if the aggregation is large enough to sustain removal.* The use of such a quota has the ability to vary in its application[68]. For example the quota could be considered instead of the IWC quota or as part of the quota. If the aggregation of seasonal resident whales is large enough to support the removal of two whales, then the quota could be two whales or two of the four whales allocated by the IWC could be seasonal resident whales. In the latter scenario, if two seasonal resident whales were taken, seasonal, spatial and behavioral delineation would have to be applied.

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[68] Future complications may arise as Canadian natives in regions adjacent to traditional hunting grounds of the Makah Tribe, assert their aboriginal whaling rights and resume a harvest of gray whales that could potentially affect the same seasonal resident group. "In transboundary situations where a stock's range spans international boundaries or the boundary of the U.S. Exclusive Economic Zone (EEZ), the best approach is to establish an international management agreement for the species" (Barlow *et al.* 1995). Barlow *et al* (1995) also suggested an interim approach which would estimate the fraction of time the stock spends in the U.S. waters, and could then be applied to the total PBR to determine appropriate levels of removal.

- *Collection of further data aimed at identifying:*

  1) If a genetic, behavioral, morphological or social differences between seasonal residents and migratory whales exists, and

  2) A more distinct period of migratory timing along the Makah whaling ground.

The above management recommendations allow for management of the scenario under which the risk of adversely impacting the putative summer resident gray whale population by means of an aboriginal subsistence harvest are at their highest. From a biological prospective, the implementation of such precautionary measures will provide the appropriate protection to the summer residents if they represent a discrete population segment. From a policy prospective, the above management strategies could put into place a framework under which the objectives of the U.S. MMPA, as well as those of the IWC could be implemented and managed for. While the biological and political status of the summer resident gray whale remains uncertain, the management strategies, suggested above, could put into place precautionary and conservative measures that both insure protection to the resource (the gray whale) without compromising those benefiting from the resource (the Makah Tribe).

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APPENDIX A:
ICRW SCHEDULE PARAGRAPH 13

IWC guidelines for aboriginal subsistence whaling are found in Paragraph 13 of the ICRW Schedule. In this Paragraph the terms by which quota are set for aboriginal subsistence takes and the number that may be taken from any given stock and reads as follows:

13(a) Notwithstanding the provisions of paragraph 10, catch limits for aboriginal subsistence whaling to satisfy aboriginal subsistence need for the 1984 whaling season and each whaling season thereafter shall be established in accordance with the following principles:

(1) For stocks at or above MSY level, aboriginal subsistence catches shall be permitted so long as total removals do not exceed 90 per cent of MSY.

For stocks below the MSY level but above a certain minimum level, aboriginal subsistence catches shall be permitted so long as they are set at levels, which will allow whale stocks to move to the MSY level.

APPENDIX B:

Profile of resident gray whales seen off Washington Coast form 1984-1998.

ID	Number of time identified by region					# of years seen
	BC	GH	GH+	OC	SJF	
1					31	1
2					7	1
3					8	1
4					14	1
5					1	1
6					1	1
7					3	1
10					3	1
11					2	1
14		24	1	1		6
15	3			2	8	3
16				1		1
17				1		1
30					1	1
37				1		1
41	3				3	2
42					8	3
43	1			8		5
61		7				1
62		17				6
63		1				1
64		4				2
65		1				2
66		4				1
67				4	1	4
68				9	9	5
71		1				1
73		9				3
74		5				1
75		5				2
76				2	1	3
77					3	1
78				1		1
79	2			2	3	2
80	7			14	2	5
81				4	3	4

ID	Number of time identified by region					# of years seen
	BC	GH	GH+	OC	SJF	
82				3		1
83				7		4
84	2			4		2
85	1			9		2
86				2		1
87			1	3		2
88				2		2
89				2		1
90				2		1
91				3	1	2
92	7			3		4
93	1			2		2
94				2		2
95				1		1
96				1		1
97				1		1
101	3				1	1
104				1		1
105				1		1
106				1		1
107				3	2	4
113		7				2
114		3				1
115		3				1
117		6	1			2
118		9	1			2
119		4				1
123	2					1
127					4	1
135	1					1
138	1					1
140					1	1
141	2			1		2
145				1		1
150	2					1
151			1			1
162		5				1
164		7				1

ID	Number of time identified by region					# of years seen
	BC	GH	GH+	OC	SJF	
166				6	6	4
169					4	1
170					3	1
171			1	1	4	3
172					2	1
173					1	1
174	1			4	1	3
175				9	18	4
176					2	1
177				4	6	2
178			1	2	1	3
180					14	2
181					1	1
183					2	1
184					1	1
185				2	12	2
186	4			1		3
187	1			13	6	3
190		3				2
191			6			1
192	4			9		3
193	1		1			2
194			2			1
195			1			1
196			1			1
197			1			1
198		1				1
199			2			1
200			1			1
201			1			1
202			3			1
203			2			1
204			2			2
205			1	2	8	2
206			2			1
207			3			1
208			1			1
209	1			6	11	3

ID	Number of time identified by region					# of years seen
	BC	GH	GH+	OC	SJF	
210				4		1
212	7			2	5	3
213			1			1
214			1			1
215			2			1
216					2	1
217					3	1
218					2	1
219	7				4	2
220					14	1
221			1			1
222			1			1
223			1			1
224			1			1
225			1			1
227	2					1
228					2	1
231	8					1
232	3					1
233	2					1
234	1					1
236	3					1
237	1					1
239					4	1
242	1			2	4	1
243	1					1
244	1					1
246	1					1
248	1					1
249					5	1
250					1	1
251				1		1
252					1	1
253					1	1
254	1					1
255					7	1
267					2	1
268					2	1

ID	Number of time identified by region					# of years seen
	BC	GH	GH+	OC	SJF	
269		9				1
270		9				1
271		14				1
272				1		1
273		6				1
304				3		1
Total sightings	90	173	46	177	301	
# of unique individuals	36	25	31	53	60	

Summary Table

# of years seen	# of unique individuals	% of unique individuals
1	108	69%
2	24	15%
3	12	8%
4	7	4%
5	3	20%
6	2	1%
Total	156	

APPENDIX C:
THE POTENTIAL EFFECTS OF A HARVEST ON SMALL POPULATIONS OF WHALES

To manage a population effectively, it is important to have some understanding of its dynamics. An understanding of its dynamic allows for the development of postulated responses to a harvest (Krebs 1994). The potential effects of a harvest will vary depending on population parameters (i.e. abundance, population growth, and natural mortality) as well as the size of the harvest. The following exercise models the potential effect a harvest of four animals (which corresponds to the average annual harvest allotted to the Makah Tribe between the years 1998-2002) could have on a small populations of whales.

Methods

To illustrate the potential effect that a harvest could have on a small self-sustaining population of whales (for instance one that may be maintained by familial recruitment) logistic growth is assumed (equation 1) and modeled.

(1) $N(t+1)=N(t) + (\lambda-1)N(t)[1-(N(t)/K)]$

Where:

N = population size
t = time
λ = maximum rate of growth
K = carrying capacity

The model was run for three theoretical populations where K was set at 200, 400 and 600. In all each model $\lambda = 1.04$ (which is equal to an R_{max} of 4% for the eastern North Pacific gray whale reported in Hill *et al.* 1997). The simulations were run for 500 years and were started at an initial population level of 0.1K. At 50% of K (the theoretical point of the Maximum Net Productivity Level (MNPL) – when the number of

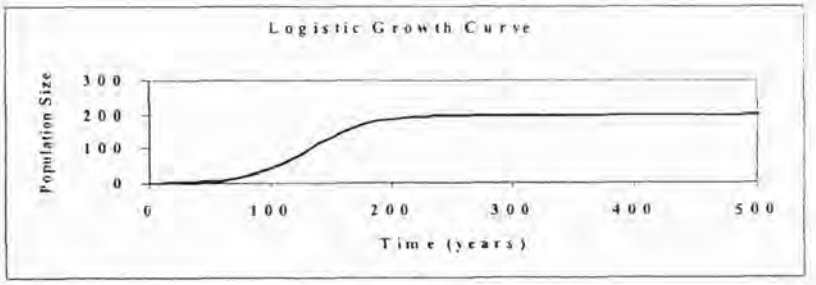
new recruits is at its greatest) a harvest of 4 animals per year was incorporated (equation 2). The harvest is assumed to be randomly dispersed among age and sex class.

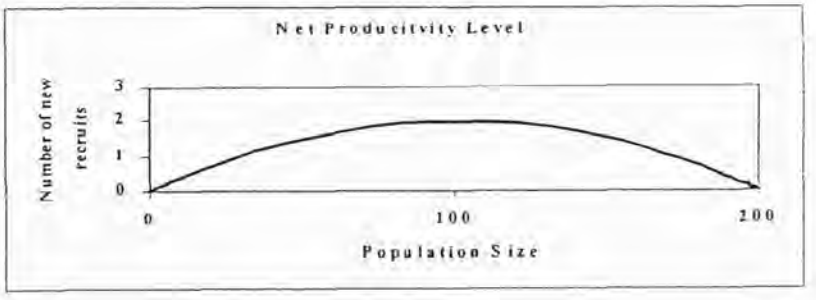
(2) $N(t+1)=N(t) + (\lambda_{max}-1)N(t)[1-(N(t)/K)]-4$

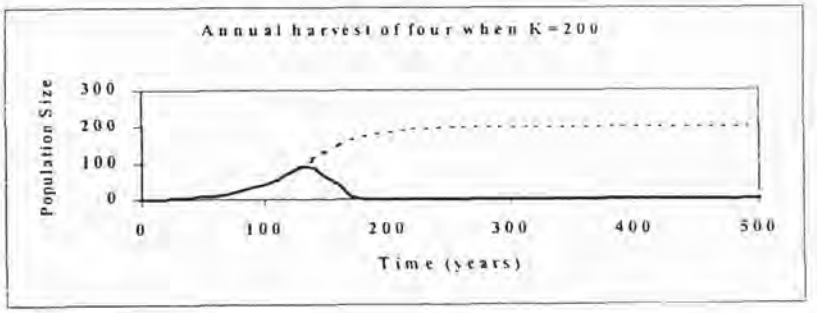
Results

When K= 200

A population where K is assumed to be 200, could not sustain an annual harvest of four animals. The maximum net productivity level for this size of a population is 2, and the annual harvest of 4 would extirpate the group over approximately 50 years.

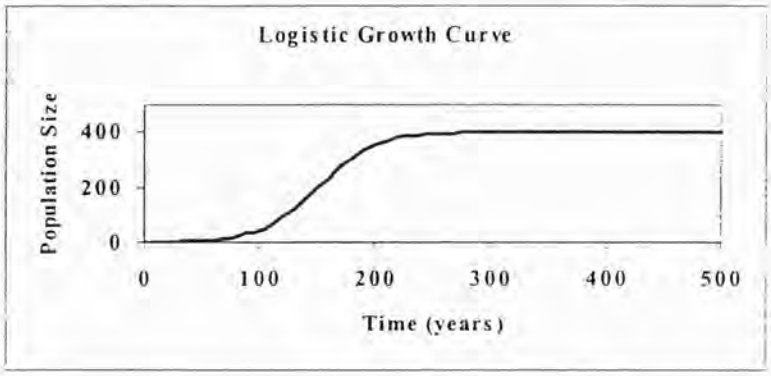


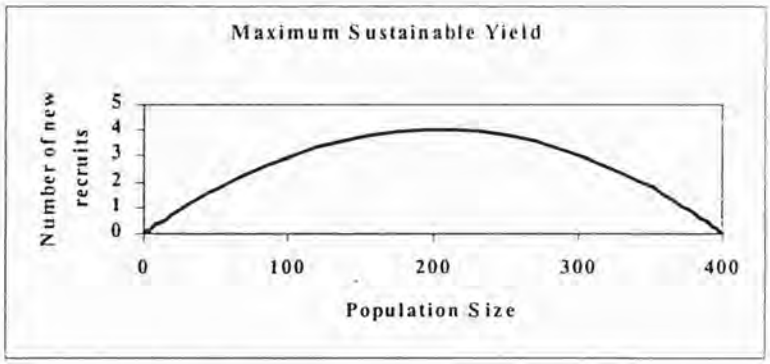


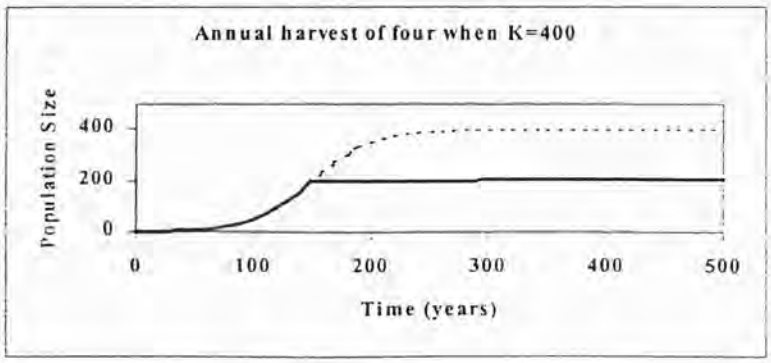


When K=400

For a population of 400, the MNPL is four animals. The population would be able to sustain an annual removal four animals, and would equilibrates at approximately 200 animals.







When K=600

For a population of 600, the MNPL is six animals. The population would be able to sustain an annual removal of four animals, equilibrating at approximately 474 animals.