A NEW VISION FOR PACIFIC SALMON

November 1996

Executive Summary

Background

The natural productivity of Pacific salmon in the northwest has declined by about 80%. Several populations have gone extinct and in Oregon some coastal stocks are at 10% or less of their historic abundance. Salmon management is in a crisis which will rapidly deepen if more of the depleted salmon stocks are listed under the federal Endangered Species List.

Even in their depleted state, the salmon are still an economic asset to some local communities. However, the strong interest in the salmon cannot be explained by economic measures alone. People who stand little chance of gaining financially from the salmon support the expenditure of funds to prevent their extinction. Local communities are increasingly coming together to implement grass roots restoration programs. The salmon have become a rallying point reviving the spirit of the community. Concerned citizens, whatever the basis for their concern, are beginning to realize that salmon depletion is everyone's problem and everyone will have to take part in devising a solution.

The current status and crisis of Pacific salmon is not what the people of the region intended when they funded salmon restoration, management and research over the last half century. Given the good intentions, why has reality deviated so far from expectations? At least a part of the answer to that question is found in the past visions for Pacific salmon. Those visions failed to effectively organize restoration and protection efforts and the guidance provided by past visions failed to solve the problem of salmon depletion.

Two visions guided salmon management over the past 120 years. The first was simply the belief that an unlimited abundance of Pacific salmon could be produced by hatcheries. The vision supported the *laissez-faire* access to natural resources that was prevalent in the late 19th century.

The current vision emerged early in this century out of the conservation movement which emphasized maximum efficiency in the use of natural resources and the post World War II emphasis on systems analysis by engineers and ecologists. Systems analysis strengthened the earlier concept of conservation by viewing watersheds as machines which could be made to operate with a high degree of efficiency once they were fully controlled. In the machine model, hatcheries are viewed as efficient fish factories and they play a dominant role in the current vision.

Today, the salmon are at the center of continuous crisis and conflict. Like the wild salmon which used to penetrate all parts of the region, the conflict touches nearly all human activities in our watersheds. At its core, the conflict is the result of a lack of balance in our approach to watershed development and salmon management. The vision for Pacific salmon has in the past emphasized development in the watersheds with the belief that hatcheries would compensate for lost habitat and over harvest. Past visions lacked a balance between the industrial and natural economies.

The problem is this: We need to retain a balance between the natural and industrial economies and that will require a shift in the way we think about salmon management and restoration and our watersheds C a new vision. The natural and industrial economies should be viewed as two anchors or parts of the foundation supporting our modern economy. If either fails, the whole will be diminished. The new vision for Pacific salmon must promote balance in the natural and industrial economies.

The New Vision for Pacific Salmon

> ***The Pacific Northwest will have sustainable, biodiverse salmon and steelhead runs in watersheds throughout the region where runs practically can be sustained.***

Local watershed stewardship and natural production should be encouraged rather than hatchery production.

The new vision shifts the focus of salmon management from artificial propagation and harvest to restoring, sustainable and biodiverse runs of salmon and steelhead. It is habitat based and designates the watershed as the basic management unit. Stewardship and husbandry of habitat and natural production will be emphasized rather than engineered, artificial solutions. This vision requires a better balance between harvest, habitat, hatcheries and hydroelectricity. While our goal is to achieve returns that support healthy fisheries, harvest management must put fish first.

While this vision will require a sustained long-term effort over the next 50 years, actions must begin now, with clearly defined and measurable milestones along the way. Specific measures must be continuously evaluated for effectiveness and efficiency in order to ensure both a healthy natural environment and a healthy economy. The vision will require the development of performance measures related to the health of the natural economy. There is a clear need for accountability. To achieve clearly defined milestones, monitoring and evaluation of meaningful performance measures and institutional accountability , a new management structure will be required.

New Approaches

The vision will require many changes in the way we manage our watersheds and their salmon and steelhead runs. Those changes are best described under four categories: harvest, habitat, hatcheries and hydroelectricity.

Harvest - The Oregon Department of Fish and Wildlife (ODFW) is dependent on license fees for support which has translated to chronic over harvest to keep clientele happy. The mechanism for funding ODFW needs to change. In the past ODFW has been overly optimistic in setting harvest targets. Under the new vision the department will have to be more conservative in its regulation of harvest, and monitor harvest and escapement more closely especially the integrity of natural spawning populations of salmon. Where there is the possibility of error, it must be in favor of the salmon. To shift the potential for error to favor salmon means that escapement of salmon in excess of the targeted number of spawners will no longer be considered a management failure.

Habitat - While the region has gradually recognized the importance of habitat problems and interested parties are beginning to work together on problems, there is still much to do. The appropriate agencies must develop performance measures for habitat health and implement reasonable monitoring programs to track progress. The restoration and management of habitat must follow two principles: 1) It's most cost effective to protect habitat rather than restore it, and 2) restoration activities should assist the stream's natural healing processes.

Hatcheries - The hatchery program needs an independent and comprehensive audit to determine why it failed to achieve its promised results and what role it can productively play in the future. Because some runs of salmon are dependent on hatchery supplementation the shift to greater reliance on natural production may have to be gradual as habitat and natural production is improved. Performance measures need to account for the negative impact of hatchery operations on natural production, because we should not pay for hatchery production that merely replaces natural production. There is a need for a public education program regarding the true benefits and costs or artificial propagation.

Hydroelectricity - Hydroelectric production and water use in general are the source of the greatest conflict between the natural and industrial economies, especially in the more developed basins such as the Columbia. Modification of the hydrosystem must be based on scientifically sound experiments carried out in an adaptive format. One institution or agency should be in charge of directing and overseeing those changes and its administrator held accountable.

Why do We Need a Vision?

About 10,000 years ago at a place called Milliken on the Fraser River and at the Dalles on the Columbia River, humans in the northwest began their close relationship with the Pacific salmon. That relationship has remained strong in spite of significant social and economic changes in the region in the past 150 years. The salmon were once an important contributor to both the gift economy of the Native Americans and more recently the industrial economy of the Euroamericans. However, since the turn of the century, the natural productivity of Pacific salmon has declined by about 80 percent. Scattered along river banks and in bays of the northwest, one can still find the remnants of log pilings that once supported canneries, silent reminders of the once great salmon industry. The salmon are still an economic asset to local communities. However the strong interest in the salmon cannot be explained by economic measures alone. The Pacific salmon are an important part of the evolutionary and cultural heritage of the northwest. Local communities invest a lot of pride in "their salmon run" and are increasingly coming together to implement grass roots restoration programs. The salmon have become a rallying point that is reviving the spirit of the community. People who stand little chance of gaining financially from the salmon support the expenditure of funds to prevent their extinction.

The salmon are currently driving a regional debate over which of the many restoration plans are scientifically sound and in the region's best interest. The debate seems to be further from resolution now than it was before the Snake River chinook and sockeye salmon were listed under the Endangered Species Act. Much of the conflict is really over policy issues carried on as though it were a discussion of science. As long as we mix science and policy, confusion and lack of effective action will be the result.

We need to view salmon restoration as a two tiered process. The first tier is the short-term technical programs and projects that are implemented to remove or circumvent constraints on production. These programs should be implemented adaptively, i.e., they should change continuously as new information is generated and evaluated. The projects in this tier are the subject of recovery plans and are the focus of current debates. But the array of technical programs needs a context, a context which is based on a longer-term view and incorporates not only scientific issues but cultural and economic factors as well. This is the second tier. It is the vision, a set of principles and assumptions that: 1) provide the solid supporting structure for the evolving technical programs, and 2) provide a yardstick against which the individual projects are evaluated. A vision is useful as long as it provides a framework that is effective in organizing and directing the development of projects that actually solve problems. Without a vision to unify and organize tasks, restoration programs often become simple laundry lists of projects about which there seems to be endless debate.

To date salmon restoration programs have focused on a single tier, the list of short-term projects, and have paid little attention to the vision. The vision has been implied rather than explicit. The objective of this white paper is to take the first steps toward the development of a vision for Pacific salmon. The vision statement should:

- Describe a desired future condition. In this case, condition means the future relationship between humans and salmon and includes cultural and economic as well as biological values.

- Identify several key features of that relationship and describe them in sufficient detail to derive policy which will direct the activities of the technical experts.

- Recognize and attempt to balance current realities with our moral obligation as the stewards of natural resources held in trust for future generations.

It would be wrong to say the region hasn't had a vision for Pacific salmon, it has, although it is not written for all to see, evaluate and concur or disagree with. In fact, later in this white paper, we will describe two previous visions. Perhaps an explicit vision was not critical until it became obvious that the past visions were failing to prevent depletion and salmon entered a crisis condition.

Nature of the Problem

The salmon are among the oldest natives of the Pacific Northwest and over millions of years they learned to effectively exploit nearly all the fresh water, estuarine and marine habitats. From a mountain top where an eagle carries a salmon carcass to feed its young out to the distant oceanic waters of the California current and the Alaskan Gyre the salmon find their way. The salmon penetrate the northwest to an extent unmatched by any other animal. They not only survive but are highly productive in a wide range of habitats. Chinook salmon, for example, thrive in streams flowing through rain forests as well as deserts; they spawn in streams that are just a few miles from source to the sea and in streams that are 900 miles from the sea; they are at home in coastal streams a few hundred feet above the sea level and in mountain streams. The ability to penetrate and adapt to such a wide range of habitats made possible the huge annual runs of salmon that once returned to streams of the northwest. Salmon are without question the region's most powerful symbol, they are silver threads woven throughout the northwest ecosystem.

The salmon's great strength is the ability to get to and be productive in habitats throughout the region. That strength is also instrumental in their depletion. The salmon's ubiquitous distribution brings them into contact with a wide range of human economic activities. Timber harvest in the headwaters, grazing, irrigation and other agricultural operations further down stream, industrial and residential development in the lower river and estuary and large scale commercial fisheries in the ocean. The salmon's extensive migrations creates an ideal situation for obfuscation. Each industry, institution or individual that contributes to salmon depletion at some point in their life cycle can point to some other industry, institution or individual that impact the salmon at some other point in the life cycle as the cause of the problem. Since the salmon's depletion is a cumulative effect of many activities, proof that absolves or implicates a single cause is impossible to obtain and is a waste of effort to pursue. This situation is fertile ground for debate and is a major impediment to the resolution of the salmon crisis. Salmon depletion is everyone's problem and everyone will have to take part in devising a solution.

While restoration of Pacific salmon in the Columbia Basin has received substantial funding and attention, the salmon problem is not limited to a single watershed. In Oregon, Washington, Idaho and California, salmon depletion is widespread. The salmon crisis is a regional problem. In 38 percent of the historic range all the species of salmon are extinct, in 56 percent of the historic range, 50 to 100 percent of the salmon are extinct or at risk, and in only 6 percent of their historic range are less than 50 percent of the salmon at risk or extinct. In Oregon's coastal streams, current production of chinook salmon and steelhead is about 50 percent of historical production and chum and coho salmon are at less than 10 percent of historical production.

The restoration of Pacific salmon in the region's streams and rivers is an important goal for many residents of the region. The fishermen who want to enjoy recreation and the fine taste of fresh salmon, the Native Americans who harvest salmon to satisfy commercial, cultural and religious needs, the non-native commercial fishermen trying to preserve a way of life, and to many others who view the presence of productive salmon populations as is a symbol of a clean and healthy environment. Some may wish to see the salmon restored to avoid the constraints associated with the Endangered Species Act. Concern about the status of salmon stems from different values, but they all have the same objective — to restore the Pacific salmon's health in the streams of Oregon and the Pacific Northwest.

It's important to consider the different values in the development of the vision for Pacific salmon. We return to the question of values later as part of a new conceptual model of watersheds. That model is the starting point for the development of a new vision.

Historical Background

Within 10 years of the beginning of the salmon canning industry the causes of its eventual decline and demise were known and acknowledged in reports to the region. In 1875, Spencer Baird, the U. S. Fish Commissioner, described the problems which would eventually eliminate the canning industry on the Columbia River and bring the remaining salmon to the brink of extinction — they were overharvest, habitat degradation and dams. The causes for the decline of salmon have not changed in 120 years. Commissioner Baird's solution to the problems in 1875 was to make fish so plentiful through artificial propagation that there would be no need for regulations of any kind. Thus harvest intensity increased, habitat continued to be destroyed at a rapid rate and dams were built first in the tributaries and then in the mainstems of the Columbia and Snake rivers. We now know that hatcheries failed to deliver on their promise of abundance, in fact, they may have caused as many problems as they solved.

Prior to the middle of the 20th century, hatchery programs were not effective. The technology was primitive and juvenile salmon released from a hatchery did not make a significant contribution to the adult runs. The early hatcheries were salmon mines, extracting the eggs from a river's run of salmon and producing little tangible benefits.

From the mid-1940s to the mid-1970s the great development program for the Columbia Basin transformed the watershed and the region's economy. The river was controlled and put to work for humans producing electricity, irrigating crops, controlling floods and transporting goods. The model for this development was the machine. The river was transformed into a machine controlled by humans for their benefit. The machine model was a success with regard to the generation of hydroelectric power, irrigation and transportation. However, the salmon production system was also restructured in a way that was consistent with the machine model and it was a failure. Although there was little or no evidence to justify their support of hatcheries, salmon managers believed that hatcheries would circumvent most of the natural freshwater life cycle of salmon and reduce the salmon's use of the river to a simple migratory channel to the sea. Some smolts are even more removed from the river in that they are carried from the upper to the lower basin in barges. Since hatcheries were designed and operated as though they were fish factories, they fit nicely into the machine model. Faith in fish culture was based on the assumption that increased survival from egg to smolt in the protected environment of the hatchery would more than compensate for habitat degradation and loss of natural production. The assumption proved false.

In recent years, the adult returns of chinook salmon have reached an all time low. However, prior to achieving those record low numbers, the hatchery program grew significantly. In 1960, 61 million chinook salmon were released from hatcheries in the Columbia Basin. The program grew to a release of 160 million juveniles in 1988. Although there have been some successes in the hatchery program, artificial propagation has failed to reverse the overall decline in chinook salmon. In a study of Pacific salmon in the northwest, the National Research Council concluded that major hatchery reforms are needed; hatcheries have been partly or entirely responsible for detrimental effects on wild populations; hatcheries have not fostered conservation of biodiversity, and some hatcheries should be abandoned if they conflict with the goal of rebuilding wild populations.[1]

While the machine model was ineffective, it has not been inexpensive. Prior to 1980, the salmon program, which was originally set at $20 million, consumed about $400 million and in the next ten years $1.2 billion was spent (including foregone power production when flow patterns are shaped to assist the migration of juvenile migration). Most of the dollars were used to fund artificial propagation or passage through the mainstem. Very little was invested in habitat. Figure 1 shows the total expenditures for salmon restoration prior to 1981 and for the ten year period from 1981 to 1991.

Past Visions for Pacific Salmon

One could argue that there have been two visions which guided salmon management over the past 120 years. The first vision was simply an unlimited abundance of Pacific salmon flowing from hatcheries. That vision was not complicated because it assumed the river was not important and could be circumvented. Hatcheries not only reduced biological complexity, they also reduced political complexity by assuming fish culture could make salmon so abundant that restrictions to protect them would be unnecessary. Under this vision, there were few conflicts between the salmon and other users of the watersheds. The vision supported the l*aissez-faire* access to natural resources that was prevalent in the late 19th century.

The current vision emerged out of the concept of conservation introduced by the Progressives early in this century and the post World War II embrace of systems analysis by engineers and ecologists. To the Progressives, conservation was the attainment of maximum efficiency in the use of natural resources. Efficiency and use were the priorities in the Progressive's view of conservation. Systems analysis strengthened the concept of efficiency even further and viewed watersheds as machines which could be made to operate with a high degree of efficiency once they were fully controlled.

[1] National Research Council. 1996. Upstream Salmon and Society in the Pacific Northwest. Washington, DC.

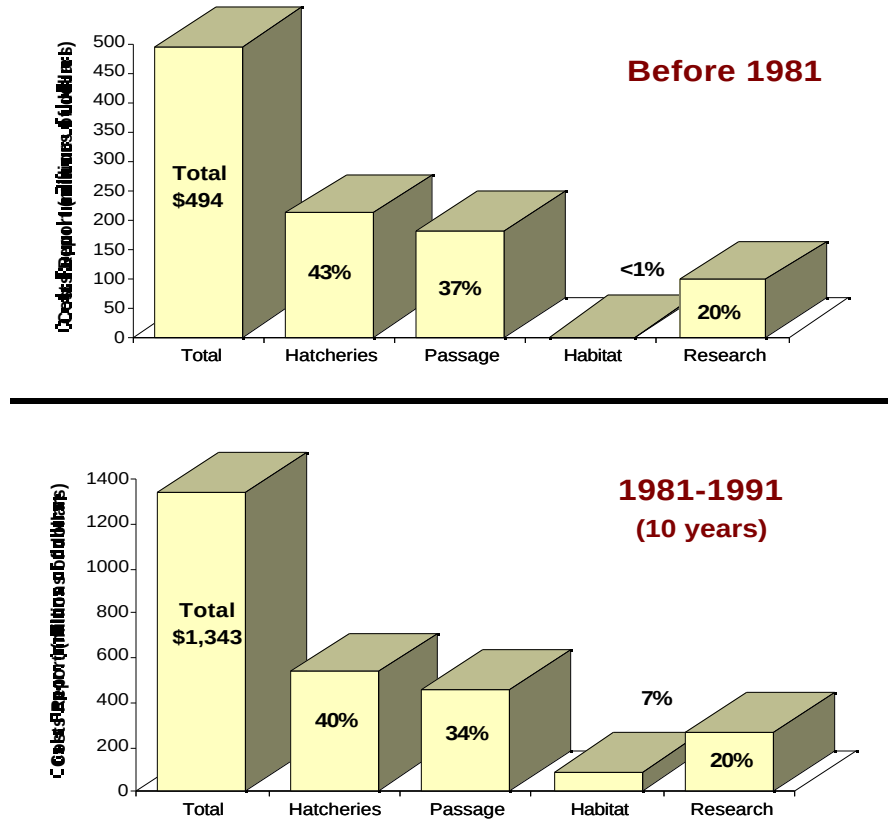


Figure 1. Cost of expenditures for salmon restoration before 1981 and in the 10 years from 1981 to 1991.[2]

The current status of Pacific salmon and the crisis it has initiated is not what the people of the region intended when they funded salmon restoration, management and research. On the other hand, salmon managers, culturists and researchers were a hard working group of professionals dedicated to maintaining the supply of salmon. Given those good intentions, why did reality deviate so far from expectations? At least a part of the answer to that question is found in the vision which was so taken for granted that it was rarely discussed or evaluated, but in fact it was failing to achieve the desired results.

[2] Source: General Accounting Office. 1992. Endangered Species Past Actions Taken to Assist Columbia River Salmon. GAO/RCED-92-173BR. Washington, DC.

Impediments to Recovery

Meaningful salmon restoration programs have a fundamental requirement: They must work in concert with the salmon's strengths. The failure of half a century of restoration programs, especially those that emphasized artificial propagation, can be traced to practices that worked against the salmon's biological strengths. Salmon restoration has often tried to circumvent or eliminate the need for habitat. Hatcheries were and are perceived as a substitute for healthy watersheds; and they fostered the idea that rivers need only be channels to the sea for artificially-propagated salmon rather than complex healthy ecosystems. The mass transfer of salmon from one river to another through hatchery programs weakened the relationship between the salmon and their native habitat, broke down reproductive isolation and destroyed the salmon's natural economy and productivity. Hatcheries didn't destroy habitat or overfish the salmon, but they offered an alternative to protection and regulation. It was an alternative that failed and so must share part of the responsibility for the current crisis.

Forests, rangeland, rivers and salmon have the internal capacity to recover from major disturbances. They have been doing so for thousands if not millions of years. The principal role for humans in the recovery of Pacific salmon is to not interfere in the natural recovery process, but to control their own behavior in a way that lets natural recovery take place. In other words, there is a strong need for the practice of stewardship which encourages the natural healing process. There are specific things we can do to assist salmon in their recovery, but what we do must work with the strengths of the salmon.

It's important to recognize that salmon productivity will change over periods of several decades due to natural fluctuations in climate or ocean productivity. Management and restoration programs must recognize those changes in real time and make appropriate adjustments. For example, when ocean productivities enter a period of depression, harvest has to be adjusted quickly to avoid deepening the production trough. During a natural low in productivity, when carrying capacities are reduced it is probably counter productive to attempt to compensate by increasing the output of hatchery fish.

Habitat is critical. No sustained recovery of salmon is possible without healthy habitat. The recovery of salmon habitat is tied to the recovery of whole watersheds. Site specific fixes (log weirs, artificial spawning beds, or other artificial stream reconstructions), which may be useful in the short term, cannot compensate for a failure of watershed level stewardship.

Salmon stocks are chronically over harvested. However, current harvest regulations do not consider the number of salmon carcasses needed to maintain the fertility of the stream nor did they consider the need to conserve the gene pools of individual salmon stocks. Failing to take stream fertility and genetics into account probably means that over harvest has been greater than once believed.

Hatcheries have been the primary tool used by managers to replace natural production lost due to habitat degradation or overharvest. Artificial propagation failed to meet those objectives and it is now known that hatcheries contributed to the decline of natural production. One important way hatcheries contributed to the decline of wild stocks was the overharvest of wild salmon in fisheries targeting aggregates of hatchery and wild populations. In the future, hatcheries will play an important role in recovery and management programs, however to identify that role will require a thorough audit and evaluation of the program and a strong commitment to adaptive management.

A New Model and Vision for Watersheds, Ecosystems and Pacific Salmon

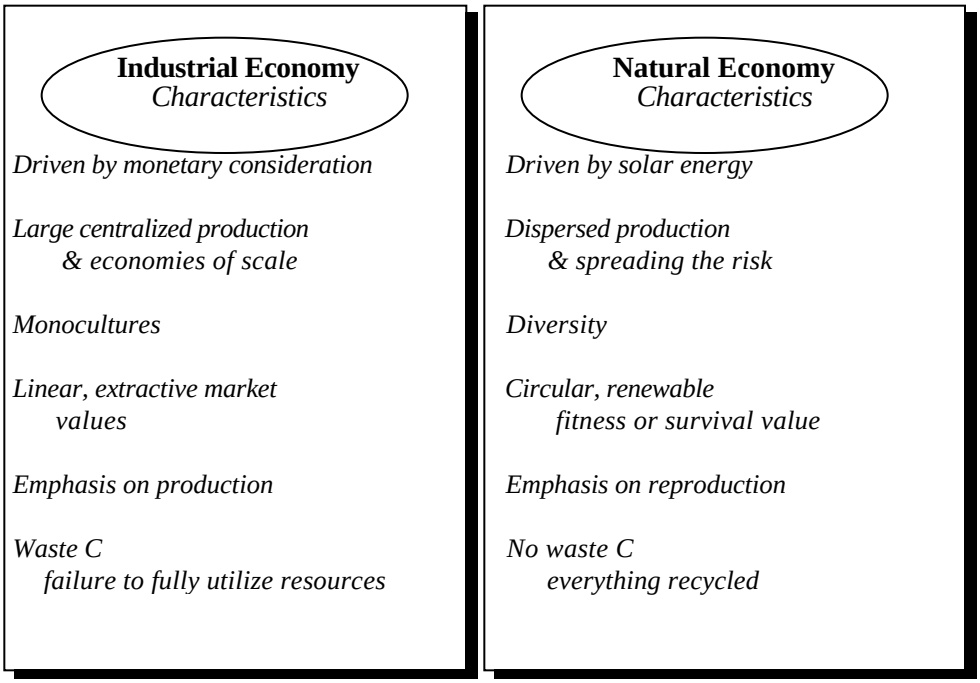
Today, the salmon are at the center of continuous crisis and conflict. Like the wild salmon which used to penetrate all parts of the region, the conflict touches nearly all human activities in our watersheds. At its core, the conflict is the result of a lack of balance in our approach to watershed development and salmon management. When we look at a watershed like the Columbia River, it's easy to identify signs of the industrial economy and the centers of its organization. Dams, the power transmission system, factories, cities, rail and road networks, farms and industrial forest operations are the external signs of the industrial economy. However, there is another economy operating within the same watersheds, an economy whose infrastructure and centers of organization are not obvious to the average person. It is the natural economy. A quick comparison between some of the principles of the natural and the industrial economies will illustrate the source of today's conflict and demonstrate the lack of balance.

Figure 2 is an abbreviated list of the characteristics of the industrial and natural economies. The industrial economy is driven by markets and monetary considerations. The natural economy is driven by solar radiation and self-organizing mechanisms that promote stability of the production stream. The industrial economy favors economies of scale in large centralized and standardized production centers, i.e., factories. Conversely the natural economy disperses production among many smaller units such as salmon stocks in many different streams. Large centralized salmon hatcheries (fish factories) are designed and managed to fit the standards of the industrial rather than natural economy.

The industrial economy is linear and extractive, where as the natural economy operates in renewable cycles. A salmon has value in the industrial economy when it is removed from its habitat, put into a can and converted to cash. A salmon has value in the natural economy if its genes maintain the fitness of the population in the next generation. Those different ways of placing value on the salmon lead to an emphasis on production in the industrial economy and an emphasis on reproduction in the natural economy.

External factors adapt the products of the industrial economy to meet the needs of changing environments. For example when the market's environment changed in the 1970s to favor fuel efficient automobiles, engineers designed new "adaptations" (fuel efficient cars) so American autos could compete with the more fuel efficient foreign autos. When a salmon population is faced with a changing environment, its adaptive possibilities are contained in the gene pool. Humans cannot create new gene pools for the salmon. In the natural economy nothing is wasted, everything is recycled.

Figure 2.
Characteristics of the industrial and natural economies.

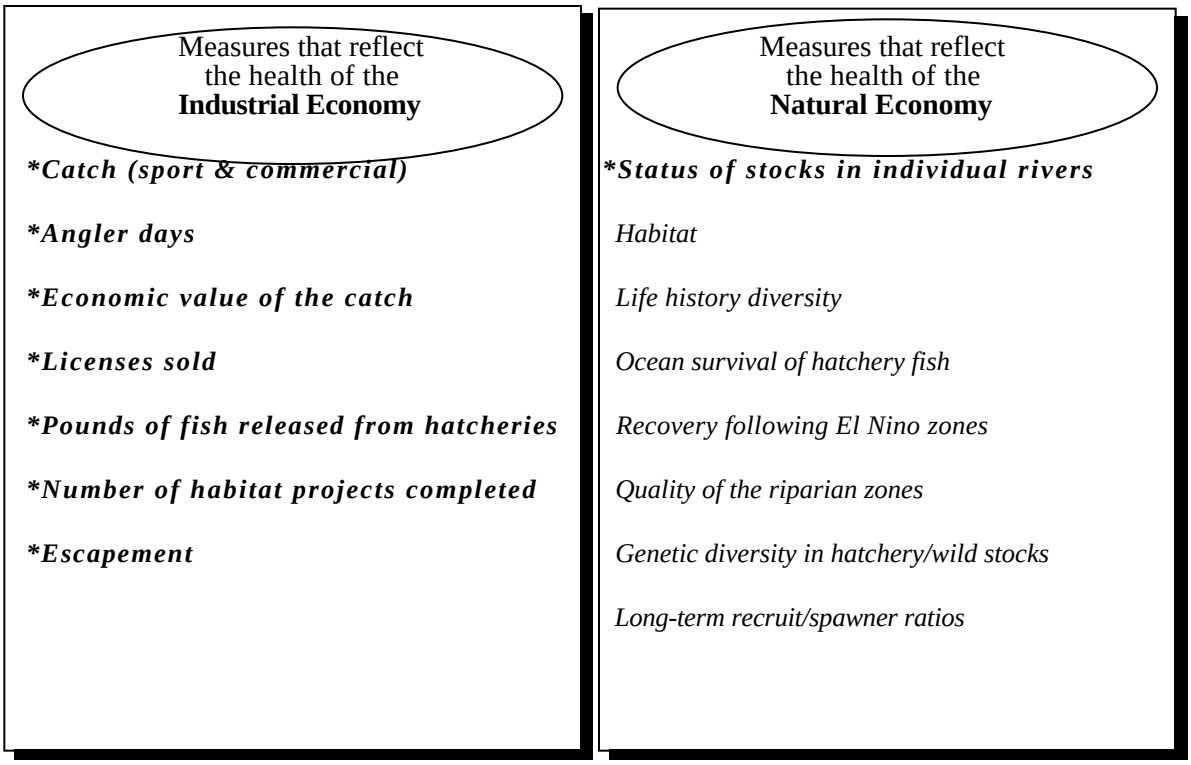


Salmon managers have a dual responsibility: to maintain a supply of commodities to the industrial economy (sport and commercial fisheries) and to maintain healthy ecosystems that produce those commodities — a healthy natural economy.

To date, the management of the Columbia and other rivers as well as the management of the salmon have emphasized the principles of the industrial economy C thus the emphasis on the machine model. The visions described earlier were heavily influenced by the industrial economy. Figure 3 illustrates the imbalance between the natural and industrial economies within the salmon management programs. Performance measures currently in use emphasize performance in the industrial economy and largely ignore the natural economy.

The problem is this: we need both the natural and industrial economies, we need to retain a balance between the two and that will require a shift in the way we think about salmon management and restoration and our watersheds. The natural and industrial economies should be viewed as two anchors or parts of the foundation supporting our modern economy. If either fails, the whole will be diminished. The new vision for Pacific salmon has to recognize the need for balance in the natural and industrial economies.

Figure 3.
Performance measures which are or could be used to evaluate effectiveness of salmon management institutions.



*Performance measures currently in use

Pacific Salmon in the Future of the Northwest

The Vision[3]

> ***The Pacific Northwest will have sustainable, biodiverse salmon and steelhead runs in watersheds throughout the region where runs practically can be sustained.***

Guiding Principles

To achieve the vision, restoration programs, future watershed development and salmon management should be consistent with the following 12 principles:

1. The salmon crisis is the result of and emphasis on the development of the industrial economy to the detriment of the natural economy.

2. All activities in watersheds must recognize the need to achieve a balance between the natural and industrial economies.

3. The restoration of salmon will be achieved through local communities, businesses and governments working together.

4. The watershed is the basic management unit.

5. Stewardship of habitat and natural production will be emphasized rather than engineered, artificial solutions.

6. Restoration will emphasize rebuilding naturally reproducing salmon populations.

[3] The vision described here was a product of workshops held on June 4 and 5, 1996. See Appendix A for a list of workshop participants.

7. Artificial propagation will be given a secondary role except in watersheds where habitat has been so degraded that natural production cannot be recovered.

8. The specific role of artificial propagation must be based on the results of a comprehensive audit.

9. Harvest management must be more conservative and favor the long-term persistence of the salmon over the short-term gain of the fishermen.

10. Although this vision takes a long-term view, restoration efforts including changes in the relative emphasis of the natural and industrial economy need to begin immediately.

11. Performance of restoration efforts must be monitored and reported. This will require a change in the management structure and development of new performance measures related to the health of watersheds.

12. Restoration programs must be implemented adaptively and there must be a high degree of accountability.

How Do We Measure Success?

Overall performance will be measured as the percentage of watersheds in which the salmon and steelhead runs have reached levels of abundance and biodiversity that ensure sustainability. Additional performance measures dealing specifically with habitat, hatcheries, harvest and hydroelectricity are discussed in the next section. Abundance and biodiversity objectives for the state's salmon and steelhead runs will be set by the technical experts, consistent with the vision's 12 principles.

How will the Vision Change Current Management?

Salmon management directed by past visions obviously failed to prevent depletion of salmon and the current crisis resulting from actual and threatened endangered species listings. If we continue the same policies, management practices and watershed degradation it's not logical to expect the future outcome will be different. To implement this new vision everyone that contributes to the degradation of salmon habitat will have to accept change and businesses should play a major role in facilitating that change. Management agencies will have to play a major leadership role in developing the technical basis for achieving the new vision. The new vision will mandate many changes in the way we manage salmon harvest, protect and restore habitat, operate hatcheries and produce hydroelectricity.

Harvest - The Oregon Department of Fish and Wildlife (ODFW) has traditionally measured performance of its salmon management entirely in terms of the industrial half of its mission. Pounds of salmon landed, value of the catch, licenses sold, angler days expended, and escapement are the traditional measures of performance and they all reflect the health of the industrial economy. Escapement of salmon to the natural spawning areas might be considered an exception; it could be considered a partial measure of the health of the natural economy. However, chronic overharvest (under escapement) indicates that escapement is not taken seriously as a measure of performance. For example, in the eleven year period 1981 to 1991 spawning escapements of coho salmon into Oregon's coastal streams met the established escapement targets three times.

The emphasis on the industrial economic half of ODFW's mission reflects the fact that the department is heavily dependent on license fees for operating funds. As a consequence, the department has been overly optimistic in its projection of salmon production which favors the fishermen rather than the persistence of the fish. The current funding arrangement creates problems when the region enters a period of naturally depressed production of salmon. During the natural lows in productivity, management must intensify to avoid deepening the natural trough in production and possibly creating problems that prevent recovery during periods of high natural productivity. However, during periods of natural lows in productivity revenue from license sales declines. Loss of revenues results in staff reduction and less intensive management when it is needed the most.

If harvest management is to comport with the *new vision*, several changes will be required:

- Source of funding for ODFW should be changed.
- Salmon conservation rather than maximizing harvest must be the priority.
- Where there is the possibility of error in regulating harvest, it must be in favor of the salmon.
- Hold salmon managers accountable for meeting the established escapement targets.
- Escapement targets should incorporate ecological and genetic factors such as the nutrient value of the salmon to the watershed and the minimum number of spawners to maintain viable and genetically diverse populations.
- The technical experts must develop a set of performance measures which will be used to track the health of the natural economy.
- Harvest managers must develop adequate monitoring programs to demonstrate a balance between the natural and industrial economies.

Habitat - The role of habitat degradation in the depletion of Pacific salmon is now recognized and local communities, businesses and government within watersheds are working together on better protection and effective restoration. The approach is gradually shifting from site specific projects to whole watershed evaluation and management. Although the problems of habitat degradation are recognized we still have a long way to go. For 120 years it was assumed hatcheries would compensate for the loss of habitat and the legacy of that false assumption will not be corrected overnight nor will it be corrected easily. Everyone has to contribute to the recovery of salmon habitat.

The approach to habitat managment has two basic principles:

- It's more cost effective to protect habitat than to restore it.
- Restoration activities should be designed to take advantage of the stream's natural healing processes and capacity.

Since salmon managment has emphasized artificial propagation and not natural production, adequate protection and restoration of habitat will at first be hampered by lack of adequate information. To remedy this, the shift to an emphasis on natural production will have to be done in an adaptive fashion, i.e., managers will have to learn by doing. That can only be achieved if there are high standards of accountability.

The new vision will require changes in our approach to habitat including:

- Habitat restoration and protection must start with an appraisal of the whole watershed rather than site specific activities.
- Habitat restoration projects must consider the whole life cycle of the salmon in a watershed, i.e., the habitat requirements of the salmon's entire history must be incorporated into habitat restoration programs. All the bottlenecks in production in all stages of the life cycle must be considered.
- Technical experts will have to design performance measures that track the quality and quantity of the habitat. Performance measures should be based on watershed analysis.

Hatcheries - Hatchery programs are popular with the public and the managment agencies. Part of the popularity hatcheries enjoy with the public stems from the overly optimistic expectations encouraged by the agencies. For example, Oregon Department of Fish and Wildlife recently distributed a bumper sticker that states "*We hatch Em' You catch Em'* ." That message is overly simplistic and does not contribute to public understanding. Given that message there should be little surprise then when the public resists changes in the hatchery programs. There is a need for massive public education regarding the salmon crisis and that education effort must include a realistic portrayal of the benefits and costs of artificial propagation.

Hatchery programs are a major source of funding for management institutions, and like harvest, the management agencies give priority to the income generating hatchery program. Hatcheries will continue to play an important role in the new vision, but that role has to be based on the results of a comprehensive review of the program. The review must be carried out in an independent and objective format. The role of hatcheries must be based on what they can contribute to the goal of self-sustaining runs of salmon and steelhead and not what they do for agency budgets.

In the new vision, artificial propagation programs will have to change in several significant ways:

- The continued expenditure of funds on individual hatcheries has to be based on their ability to meet clearly defined objectives, which are consistent with the vision.

- Hatchery performance cannot be evaluated by contribution to fisheries alone. Artificial propagation must add to the total production rather than replace natural production.

- Priority must be given to natural production in watersheds where it is possible to recover self-sustaining, naturally reproducing runs. Where natural and artificial propagation is to be integrated in a watershed, the burden of proof rests on the hatchery operation, i.e., it must be demonstrated that hatchery operation will not threaten the recovery of natural production.

- Managers will have to devise innovative harvest strategies to capture hatchery salmon without risking the recovery of natural production in a watershed.

- ODFW must undertake a public education program that describes the true benefits and costs of hatchery programs including costs to natural production.

Hydroelectricity - Dams and reservoirs for the production of hydroelectric power have altered natural riverine processes and reduced or eliminated habitat for Pacific salmon. In addition, the mainstem dams and reservoirs have increased the mortality of juvenile and adult salmon during their migrations. On the other hand, the production of electricity from the many hydro projects in the region have had a major impact on the region's economy. The highly developed state of the Columbia River and the continuous decline of salmon, suggests that the survival of salmon above McNary Dam will require additional modification to the operation of the hydrosystem. However, the annual flow patterns through the hydrosystem have been drastically altered in the past few years to favor salmon recovery. Because of the cost of those changes, research on their effectiveness is needed to justify additional alterations. There is a critical need for a well managed adaptive approach so the most effective use of the water for salmon and hydropower is achieved.

There is a great deal of uncertainty regarding the benefits to be obtained from various ways to modify the hydrosystem for the benefit of salmon. It is imperative that any future modification be done adaptively, using well designed and peer reviewed experiments with clear accountability to learn from those experiments and system modifications based on science. In any attempt to modify the operation of the system, the naturally produced salmon should be given first priority over hatchery fish.

Hydroelectric production and water use in general are the source of the greatest conflict between the natural and industrial economies, especially in the more developed basins such as the Columbia. While it is recognized that the dams on the mainstem Columbia and Snake rivers are a major source of mortality for salmon, attempts to mitigate that mortality must take into consideration the salmon's entire life history and the need to maintain biodiversity. For example, barging, when it is employed should transport all life histories of the target species. All the salmon in a given migration should be barged rather than selecting a specific segment of the migration for transport.

The new vision for Pacific salmon will require changes in the use and allocation of water in the Columbia Basin. Those changes include:

- Study the current hydrosystem to determine the best opportunities to restore important ecological processes and salmon habitat to the mainstem Columbia River.

- The region must determine how far it is willing to go to recover salmon in the Columbia River and how much it is willing to expend on salmon recovery in terms of lost power and increased cost of electricity.

- Given the opportunities and the level of willingness to absorb more costs; it's important to determine the best scientific approach.

- Place responsibility and accountability for salmon recovery in a single institution.

- When changes in long-standing practices are needed such as an alteration in historical irrigation practices, the changes should be based on clearly understood plans with time to adapt to new practices.

Managing Change

Progress in salmon management and restoration is hampered by the fragmentation of responsibility and authority among several federal, state, and local agencies and jurisdictions. This was recognized as a problem in 1938 by the Oregon State Planning Board and in 1943, by Columbia River Fisheries Interim Investigation Committee of the Washington State Senate. The problem has gotten worse. Even within institutions, separate divisions tend to focus on their prime responsibility with little regard for impacts on the activities of other divisions. For example, we pointed out earlier the problem of chronic overharvest which defeats the effectiveness of habitat improvement and efforts to enhance natural production.

The new vision will require institutional change. Some of those changes are included in the 12 principles. Other changes are discussed under the separate categories of harvest, hatcheries, habitat and hydroelectricity. To fully implement the vision, activities in each of those areas must be fully integrated. In the new vision, management must continuously cross the boundaries of the four H's: Harvest, hatcheries, habitat and hydroelectricity. Increased accountability will be an important first step in the relaxation of institutional barriers to salmon restoration.

Resource Allocation

Funds for salmon restoration while significant are not unlimited so it is critical that administrators be able to effectively set priorities based on resource rather than agency needs. The ability to effectively set priorities is inversely proportional to the level of institutional fragmentation. Productive allocation of financial resources will require relaxation of the institutional barriers discussed above.

The effective allocation of resources also needs a broad strategy which gives direction to the setting of priorities. We propose a two step strategy:

- Since the watershed is the basic management unit, priorities should be set first at the watershed level. Restoration of a whole watershed is more important than dispersed, piece meal efforts in many rivers.

- Highest priority should be given to the least damaged watersheds, those that still contain viable core populations and some quality habitat. This is consistent with the principle that protection of existing quality habitats is the highest priority.

This strategy will promote effective use of resources and it will lead to early successes which will be important to maintain active community participation. Focusing on the least damaged watershed will also provide experience and adaptive learning that can be applied to more difficult restoration cases.