

December 11, 1998
Operational Protocols
with Emphasis on Genetics and Conservation Management
for Coho Hatchery Stock 52, Cole M. Rivers Hatchery
Rogue River, Oregon

Introduction:

The following operational protocols apply to Coho Hatchery Stock 52 at Cole M. Rivers Hatchery in the Rogue River Basin. The Rogue River includes five wild coho populations that are part of the Southern Oregon and Northern California, or Trans-boundary coho salmon ESU. This ESU was listed as a threatened species under the federal Endangered Species Act in 1997. Coho salmon are also Oregon state sensitive species. The hatchery facility, including the release site, is located within the geographical distribution of the wild population above Gold Ray Dam (see Figure 1 for wild fish population distributions and facility locations). The hatchery program was initiated in 1975. The protocols presented in this document were developed in 1997-98 and are considered effective as of 1998.

Program Goals:

The Cole M. Rivers Hatchery program for Coho Hatchery Stock 52 is intended to accomplish the following goals:

***Goal 1:** Coho hatchery stock 52 will be managed as an artificial reserve to retain future management options in the recovery of Rogue Basin coho. The reserve is not planned for use at this time, but may be used in appropriate recovery actions in the future if needed. This action is intended to be beneficial to the recovery of the listed coho.*

***Goal 2:** Coho hatchery stock 52 will be used to provide monitoring opportunities for Rogue River coho related to ocean distribution and marine survival; and also to provide information on incidental harvest mortality of wild coho in a hatchery fish-only harvest. This information is useful in the conservation management of the listed coho; therefore this action is intended to be beneficial to the recovery of listed coho.*

***Goal 3:** A hatchery fish-only harvest will be allowed on coho hatchery stock 52 as long as incidental harvest and associated hatchery risks are held within acceptable limits as specified in the Section 4(d) rule (Federal Register Notice 62, 1997). This goal is not intended to benefit listed fish.*

***Goal 4:** This hatchery program was initially authorized to produce 2,060 adult hatchery coho in lieu of wild production lost to the construction of federal dams*

in the upper Rogue River basin. This mitigation goal is not intended to benefit remaining wild (listed) fish.

Operational Protocols and Monitoring for Accomplishing these Goals:

Protocols that Establish General Program Concepts

This hatchery broodstock is designated as an artificial reserve for the federally listed (threatened) wild coho salmon in the Rogue River Basin. An artificial reserve requires specific management and monitoring protocols as established in this document. General concept protocols include:

1. This hatchery broodstock is designated “Coho Hatchery Stock 52” and is maintained at Cole M. Rivers Hatchery on the Rogue River.
2. Coho Stock 52 will be managed as a “wild-type” broodstock associated with the wild population above Gold Ray Dam, as directed by the protocols provided in this document.
3. A “wild-type” broodstock is one that is closely integrated with a wild population so that it will retain the necessary characteristics to be potentially useful in recovery actions. One implication of being “closely integrated” is that the broodstock and wild population essentially function as a single biological breeding population, with some portion of this breeding population dependent on captive breeding.
4. In this program, only part of the breeding population will be dependent on captive breeding; the rest will be left in the wild and unaffected by captive breeding to the extent achievable.
5. Some wild fish need to be brought into the reserve periodically to maintain its adequacy for potential use in recovery. In this program, wild fish will be added to the broodstock annually so that it will not diverge to form a new population.
6. The wild population will be protected from the affects of the hatchery program by limiting natural spawning by hatchery fish. This protocol will remain in place as long as the artificial reserve is not used in recovery activities. Natural spawning by hatchery fish will be restricted to 10% or less of any natural spawning population to protect the remaining natural spawning part of the population from the risks introduced by artificial production.
7. If it is ever determined that these hatchery fish will be used as part of a recovery action, additional operational protocols will be developed to optimize chances of successful integration of the hatchery fish into natural production. These protocols may include consideration of “NATURES”-type natural rearing strategies, alternative release strategies such as releases of adults or other life history stages, or other strategies that are determined to be effective at contributing to successful natural production. The specific locations where the

- hatchery fish would be used would be identified and a risk/benefit analysis on the alternative protocols would be conducted prior to implementation of any such programs.
8. Captivity will occur during spawning and during rearing from egg to smolt.
 9. The artificial reserve is to be maintained indefinitely into the future, but currently not used.
 10. The only wild donor for Coho Hatchery Stock 52 will be the wild population above Gold Ray Dam.
 11. No transfers into Coho Hatchery Stock 52 from any other hatchery broodstock is permitted.
 12. The protocols provided in this document focus on issues pertaining to genetics and conservation management; in particular regarding interactions between hatchery and wild fish. Additional protocols for rearing, diet, disease treatment, additional monitoring and etc. may also be implemented. Any conflicts that arise between other operational protocols and those presented here should be formally addressed and resolved to maintain the intent of all operations.
 13. This hatchery program was initially provided as mitigation in lieu of lost natural production caused by federal dams in the upper Rogue River basin, specifically Lost Creek, Applegate, and Elk Creek dams. However, while the hatchery program replaced natural production by wild fish, it was not intended to benefit wild fish. It is therefore recommended that both ODFW and NMFS identify other alternative mitigation programs for the upper Rogue that would benefit wild fish. Among these alternative actions, both ODFW and NMFS should continue to pursue the removal of Elk Creek Dam to allow unimpeded passage of coho into upper Elk Creek.

Collection and Spawning of Broodstock

The following protocols apply to the collection, handling, spawning and other deposition of adults captured in the hatchery trap:

1. Sampling and Collection of Broodstock:
 - a) The hatchery broodstock will be drawn from those coho that volitionally enter the Cole M. Rivers Hatchery trap. It is expected that several thousand coho will enter the trap each year.
 - b) The hatchery trap will operate both before and after coho arrive at the site, and is known to catch all sizes of fish that encompass the entire coho size and age distribution. Therefore the trap is not considered to be selective for coho run-timing, adult size or age.

- c) It is recognized that the sample of coho collected in the trap is skewed toward hatchery fish and toward that part of the wild population that resides in the mainstem Rogue just below Lost Creek Dam.
- d) The target broodstock size will be 300 fish annually.
- e) Excepting those issues identified in this section, broodstock will be selected at random from among the fish that are captured in the trap, neither favoring nor discarding potential broodstock according to any characteristic observed.
- f) Returning hatchery adults that enter the hatchery trap are candidates for use in the broodstock. Since all smolts for this program are released at the site of the hatchery trap, each hatchery family should have an equal probability of contributing to future broodstocks.
- g) The ESA Section 4(d) rule limiting take of wild Rogue River coho, combining both harvest and hatchery take will be adopted as the standard for the allowed number of wild fish that can be taken into the broodstock. The take limits depend on marine survival and abundance. Allowable exploitation rates may range from 15% under conditions of low marine survival up to 35% under conditions of high marine survival and depending on the parent escapement levels. The variation in take would probably all occur in the harvest since the take by the hatchery would continue to be driven by entry of wild fish into the hatchery trap which appears to be a fairly constant proportion of the wild fish at Gold Ray Dam.
- h) Wild fish will be selectively favored for use in the broodstock, while complying with the limit on take set by the ESA Section 4(d) rule. The optimal minimum number of wild fish added to the broodstock each year is 30% of the broodstock. More wild fish may be used up to the 4(d) rule limit. However, the 4(d) rule limit takes precedent over the 30% optimum. This means for example that, under current conditions of abundance and marine survival, less than 30% of the brood can be wild fish if necessary to comply with the 15% limit. It is recognized that this sampling design is highly skewed toward wild fish, which typically make up less than 5% of the fish that volitionally enter the trap.
- i) Based on data from 1994 through 1997, the take of wild fish into the hatchery will remain below the take limit, with allowance for expected harvests, if approximately 5% of the wild fish observed at Gold Ray Dam are taken into the trap. Hatchery and district staff should consult in early December to compare the two counts and determine their progress toward meeting the limit. If it appears that there will be excess wild fish taken staff should prepare to release some of them into appropriate natural spawning areas above Gold Ray Dam.
- j) Hatchery take will be measured as the number of wild fish captured in the hatchery trap and retained for broodstock.

- k) Selection of broodstock from the sample in the trap will be stratified across spawning time by collecting one half of the brood from those fish that spawn before Dec. 15 and the other half of the brood from those fish that spawn after Dec. 15. If any excess brood are taken prior to Dec. 15 the excess egg takes will be eliminated at the eyed egg stage to bring the sampling into line with this protocol.
- l) Jack males will be used in the broodstock, but limited to 5% to 10% of the males spawned. It is recognized that this proportion is about 1/3 to 1/2 of their occurrence in the trap.
- m) The proportion of jacks in the wild population should be compared annually to the proportion among the hatchery fish, measured at Gold Ray Dam. As of 1997, the proportion of jacks in the wild population exceeds the proportion among hatchery fish. Therefore, the use of jacks should be increased toward the upper part of the range provided in l) in an effort to bring the proportions in the wild population and among hatchery fish into closer alliance.

2. Spawning Protocols:

- a) Standard manual spawning methods will be used to optimize reproductive success for this broodstock. The option of live-spawning and releasing wild fish will be retained and may be used if it is determined to be necessary in order to include some wild fish in the broodstock while still meeting the 4(d) rule limit on take.
- b) An equal number of females and males will be spawned each year (50:50 sex ratio).
- c) Each fish will be paired with a single other individual drawn at random from the other fish that are ripe on the same day.
- d) Wild fish will also be spawned at random with any other fish chosen for the broodstock, either hatchery or wild, that are ripe on the same day. The probability that hatchery and wild fish will be paired will therefore depend on their relative proportions in the broodstock.
- e) Each fish will be spawned only once.

3. Deposition of Excess Adults taken in the Hatchery Trap:

- a) Any hatchery coho taken in the hatchery trap that are excess to broodstock needs will be properly disposed of. No adult hatchery coho are to be released back into the Rogue River basin.
- b) Any wild fish captured in the Cole M. Rivers hatchery trap in excess of the allowed take under the section 4(d) rule will be released into natural spawning areas above Gold Ray Dam. District staff will determine the release locations.

- c) Releases into areas that are being used for spawning ground counts will be avoided in order to minimize complications with the wild fish monitoring program for this population, but any other areas that provide adequate natural spawning habitat can be considered as release sites. Potential release sites currently identified include: Big Butte, Elk, Trail and Little Butte creeks.
 - d) The district recommends that the adults selected for release should be held until just before spawning and they should receive treatment for fungus during that time. These measures might improve their survival after release.
4. Monitoring: The following broodstock phenotypic characteristics will be monitored annually:
- a) Actual number of males and females selected for the broodstock;
 - b) Date of passage at Gold Ray Dam, specified by hatchery and wild fish;
 - c) Date of entry into the Cole M. Rivers Hatchery trap, specified by hatchery and wild fish;
 - d) Date of spawning in the hatchery, specified by hatchery and wild fish;
 - e) The number of jack males trapped;
 - f) The number of jack males spawned;
 - g) The proportions of jack males in the wild population and among the hatchery fish measured at Gold Ray Dam.
 - h) The sex ratio of the fish trapped (total number of males and females);
 - i) The actual number of males and females spawned, specified by hatchery and wild fish;
 - j) Fork length of adults trapped, specified by hatchery and wild fish;
 - k) Fork length of adults spawned, specified by hatchery and wild fish;
 - l) Fecundity of females spawned;
 - m) In addition to monitoring these phenotypes, any catastrophic loss of brood adults or any other modification of broodstock sampling and spawning design should be documented in detail.

Rearing and Release of Juveniles

- 1. Rearing Protocols:
 - a) Egg to smolt survivals in the hatchery will be the highest achievable.

- b) Each family will be given an equal chance to produce an equal number of smolts. This means that all rearing practices will be as non-selective as possible and each family will receive the same treatment.
- c) In keeping with the protocol for high survival to smolts, diets, juvenile husbandry practices and disease treatment and control will be optimal for maximizing survival.
- d) Disease management protocols can include the following routine treatments as needed:
 - i) Treating brood fish for external fungus using formalin.
 - ii) Treating juvenile fish for external parasites using either hydrogen peroxide or formalin.
- e) Culling of excess production will occur at either the eyed egg or pre-smolt stage.
- f) All culling will be done at random with an equal probability of affecting each family. This includes:
 - i) Cull all families to an equal size as eyed eggs;
 - ii) Excess pre-smolts will be culled at random from the mixed pool of pre-smolts.

2. Release Protocols:

- a) The only release location for smolts produced from this program will be as acclimated smolts at the hatchery location (mainstem Rogue River, RM 157).
- b) Each family reared at the hatchery should be given an equal probability of having smolts released. This objective should be accomplished as long as rearing and release protocols are non-selective.
- c) Release smolts that are ready to promptly out-migrate. This should limit the duration of interaction between hatchery and wild juveniles. Indicators of meeting this need include:
 - i) Releases shall be volitional;
 - ii) Releases should be of smolts that average 10 fish/pound;
 - iii) Releases should occur during peak out-migration time for wild smolts, on or about May 1.
- d) Discontinue releases of coho eggs and unfed fry in the Rogue basin. Other species can be substituted for school programs that previously used coho. Possible alternative species include, but are not limited to, spring chinook.

e) Excess pre-smolts can be released into closed water bodies where they provide trout fishery benefits but cannot interact with wild coho. Currently Applegate and Emigrant reservoirs are used.

3. Monitoring:

a) All hatchery coho smolts reared in the Rogue basin will be marked. This includes hatchery coho stock 52, plus any out-of-basin stocks that are reared at either Cole M. Rivers or Butte Falls hatcheries.

b) A minimum of 25,000 smolts need to be marked with a CWT and adipose clip in order to monitor marine survival.

c) A minimum of 25,000 smolts need to be marked with a CWT but no external mark to monitor incidental harvest mortality.

d) All other smolts will be marked with an adipose clip.

e) Hatchery fish egg to smolt survival will continue to be monitored in the hatchery using standard inventory methods.

f) Any catastrophic losses of eggs or juveniles will be documented. It should be noted whether such losses were specific to particular families or otherwise selective. Generally the only losses that could be specific to families would occur early in egg incubation since families are mixed after that stage.

g) A disease monitoring plan will be implemented (provided in Table 1).

h) Any observation of genetic recessive traits in this broodstock, such as albinism, will be documented. No such traits have been observed to date.

i) The department should consider periodic checks on hatchery smolt out-migration duration and success. These checks may include smolt-trapping in the lower Rogue.

Post-Release and Deposition of Hatchery Adults

1. Deposition of Hatchery Adults

a) Straying by hatchery coho stock 52 into any population in the Rogue basin will be held to the lowest achievable level, not to exceed 10% of any natural population size.

b) Straying by hatchery coho stock 52 outside of the Rogue Basin, and straying into the Rogue from any other coho hatchery stock will be held to the lowest achievable level, not to exceed 5% of any natural population size. There is currently no evidence of such straying.

c) If strays from any other coho stock are ever detected in the Rogue, a weighted total stray rate, considering all sources including from within the

Rogue and from other sources will be calculated. There is currently no evidence that this measure is required.

- d) ODFW staff will continue to improve our information about the natural spawning distribution above Gold Ray Dam, including the relative distribution of wild and hatchery fish;
- e) If the stray rate limits are being exceeded, ODFW staff will develop protocols to reduce the stray rate. Options that may be considered in these efforts include:
 - i) Hatchery adults can and should be removed in any traps where they are captured. Captured hatchery adults can be used in the broodstock or otherwise appropriately disposed of.
 - ii) Hatchery adults can be selectively removed in Rogue basin harvests.
 - iii) Hatchery adults can be selectively removed from areas where they concentrate above Gold Ray Dam using angling. The angling may be a sports fishery or may be implemented as an organized management action.
 - iv) A bay or bubble sports fishery on hatchery coho at the mouth of the Rogue River can be considered as a method to decrease the number of hatchery strays in the Rogue basin.
 - v) The take provisions specified by the ESA section 4(d) rule are adopted as a standard for any harvests associated with this hatchery program. This take combines that permitted incidental to harvest on hatchery fish or other species with the take that occurs in the hatchery. It is anticipated that the take into the hatchery will always be from about 3% to 7% since it driven by the volitional entry of wild fish into the hatchery trap. Therefore, the incidental take in the harvest needs to provide for this amount.
 - vi) Hatchery adults may be concentrated into areas in the basin where there are no wild fish spawning. The most likely location where this might occur in this program is in the slough and mainstem immediately below the hatchery. This area will be explored to determine if hatchery fish are concentrating there and if any wild fish are also using this location for spawning. If wild fish are not present, any hatchery fish concentrated into this area may be considered effectively removed from the natural spawning population.
 - vii) The number of smolts released for this program may be decreased to decrease the stray rate. It is recommended that a minimum release of 50,000 smolts always be retained for monitoring and broodstock needs.

- f) Actions to decrease stray rates may be implemented immediately after their effectiveness in doing so is determined.
 - g) If any population's proportion of hatchery fish continues to exceed 10% for a rolling average of three years, additional remedial actions to decrease this proportion must be taken.
 - h) Ecological interactions due to adult hatchery coho or offspring of these shall be considered adequately controlled if the stray rate limit of 10% is achieved.
2. Monitoring:
- a) Hatchery fish will be identified as such based on applied marks and tags, including fin clips, coded wire tags, or other applied marks. All unmarked fish will be designated wild fish.
 - b) Hatchery to wild ratios will be interpreted and reported as a population-wide measure for each of the five coho populations in the Rogue Basin.
 - c) A tag retention error/loss rate will be calculated annual to estimate the number of possible unmarked hatchery fish in this system. The current error rate is low, accounting for only a few adult fish in the basin. If the error rate increases measures will be taken to improve tagging.
 - d) Hatchery fish smolt to adult survivals will continue to be monitored using coded wire tags. A minimum of 25,000 smolts will be tagged CWT/ad clip.
 - e) Marks can be recaptured in ocean harvests, sports harvests, on natural spawning grounds, at the hatchery trap, and at any other location where hatchery fish are collected.
 - f) A program to monitor hatchery to wild ratios on natural spawning grounds throughout the Rogue River basin will be implemented annually. The proposed monitoring program is provided in Table 2 and Figure 2. The number of reaches surveyed annually may increase as additional coho spawning areas are located.
 - g) Double index marking to measure incidental mortality in catch and release fishing will continue using coho hatchery stock 52 as one study group. A minimum of 25,000 smolts need to receive coded wire tags with no external marks for this study. This activity is planned to continue indefinitely.
 - h) Further protocols for harvest management and monitoring are provided in Amendment 13 to the Pacific Coast Salmon Plan.

Additional Monitoring

The following monitoring of wild fish populations in the Rogue Basin will also continue as part of the implementation of this program.

1. The wild population abundance above Gold Ray Dam will continue to be monitored using dam counts.
2. The total wild abundance into the Rogue Basin will continue to be estimated by measuring hatchery to wild ratios in seine samples at Huntley Park, assuming a 10% “loss” of hatchery fish during migration up the Rogue, measuring total hatchery abundance based on either returns of hatchery fish to the hatchery trap or on counts of hatchery fish at Gold Ray Dam, and expanding from the ratio to a total wild abundance for the basin. This abundance will be considered a return to river mouth abundance. Total pre-harvest abundance will be estimated by expanding this number using the harvest rate.
3. Efforts to locate additional coho spawning areas in the Rogue Basin will continue. The number of locations included in Rogue Basin spawning ground counts to estimate both wild population size and hatchery to wild ratios may be increased as new areas are located.
4. Reproductive success to Gold Ray Dam will continue to be measured for both wild and hatchery fish, comparing parent to adult offspring abundance at the dam.
5. The estimates of harvest rates will be calculated using the FRAM model. The measurement of incidental mortality due to catch and release will continue to be refined using the monitoring program described under Goal 2 for this hatchery program.
6. It is recommended that some direct measurements of wild coho survivals be initiated in the Rogue River basin. These measurements may be periodic rather than annual and the methods selected and frequency of taking measurements should be designed to minimize impacts to wild fish.
7. It is recommended that information on the size of wild coho smolts be gathered in this system.

Catastrophic Risk Management

1. To safeguard against catastrophic loss of broodstock excess adults may be retained and extra egg takes may occur when adults are available early in the run. If this measure is implemented all excess early takes will be eliminated at eyed egg stage in order to return the actual spawning distribution to ½ of the spawners coming from those spawning prior to Dec. 15 and ½ coming from those spawning after Dec. 15.
2. The current broodstock size is set at 300 fish. If production goals of 200,000 smolts are not met for two consecutive years the broodstock size can be increased.

3. Among ripe males selected for spawning, those that have more fungus will be used first since they have a lower probability of survival to the next spawning date.
4. To safe guard against catastrophic egg or juvenile mortality excess egg takes will occur; the excesses will be culled across all families as indicated under Rearing Protocols, above, at either the eyed egg or fry stage.
5. A program to monitor disease and control outbreaks will be implemented (Table 1).
6. Any catastrophic events that affect this broodstock and hatchery program will be carefully documented. Any potential selectivity of such events will be described. Major events may require formal review to determine consequences and response protocols.
7. Accidental escapes from Butte Falls Hatchery facility, which is also located in the Rogue basin, will be prevented by double-screening all rearing pond outlets.
8. Accidental escapes from releases of presmolts into reservoirs can be prevented. Fish attempting to escape from the reservoirs through regulating outlets undergo pressure changes that cause high mortality. Escapes through the spillways are rare because the projects rarely spill. Applegate has spilled only once since construction. Emigrant Reservoir spills more often but feeds into upper Bear Creek which is poor fish habitat. Any fish that do escape Emigrant are unlikely to survive to reach areas occupied by coho.

Table 1. The fish health monitoring plan is identical to that developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin Anadromous Salmonid Hatcheries, Annual Report 1994. Bonneville Power Administration).

- All fish health monitoring will be conducted by a qualified fish health specialist.
- Annually examine brood stock for the presence of reportable pathogens. Number of individuals examined, usually 60 fish, will be great enough to assure the detection of a pathogen present in the population at the 5% level. American Fisheries Society “Fish Health Blue Book” procedures will be followed.
- Annually screen each salmon brood stock for the presence of *R. Salmoninarum* (R.s). Methodology and effort will be at the discretion of the fish health specialist.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices will be reviewed as necessary with facility personnel. Where and when pertinent, nutrition, water flow and chemistry, loading and density indices, handling, disinfection procedures, and treatments will be discussed.

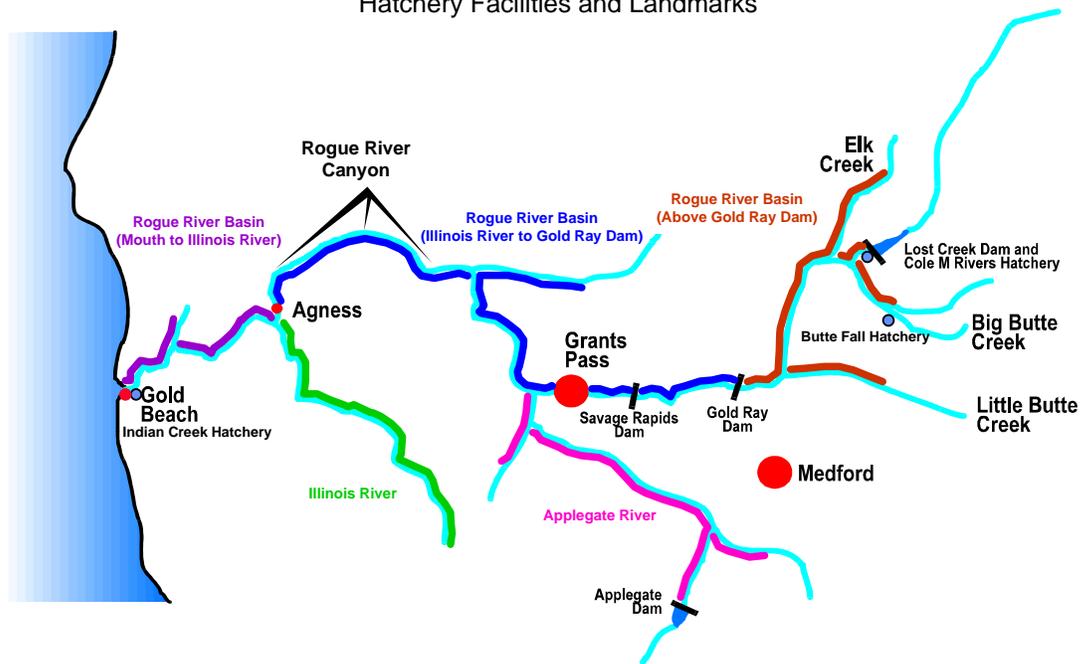
Table 2. Program for Monitoring Hatchery to Wild Ratios in the Rogue Basin.
Figure 6 also provides a map of the locations.

Type of Monitoring Site	Specific Locations	Description
Counts at Dams, Weirs and Traps	Gold Ray Dam	<p>This count provides a total count of the fish, both hatchery and wild, entering the population above Gold Ray Dam. The fish are distinguished as hatchery or wild based on fish clips. The fish that enter the hatchery trap are subtracted from the dam counts to enumerate the fish remaining to potentially spawn naturally. Measurements to date include: Accurate since 1994-95 Sample sizes: 2,863 to 4,646 fish Ratios: 11% to 51% hatchery fish</p>
	Elk Creek Dam	<p>This count provides a count of the fish passing the Elk Creek Dam site. Elk Creek is a major coho-producing tributary just below the hatchery. The trap samples a substantial proportion of the fish entering Elk Creek. This is a temporary option because the facility may be removed in the next year or two. Measurements to date include: Accurate since 1994-95 Sample sizes: 281 to 442 Ratios: 7% to 28% hatchery fish</p>
	Huntley Park Seining	<p>Seining at Huntley Park, near the mouth of the Rogue, is part of an effort to estimate total abundance of coho in the Rogue River Basin. Initially, the seine catch, combined with an estimated sampling efficiency, was used directly to estimate abundance. The current method collects only hatchery to wild ratios during seining. These ratios are used along with the count of hatchery fish returning to Cole M. Rivers hatchery trap to estimate total wild coho abundance entering the Rogue basin. Although this measure is taken annually, it will not generally be used as an estimate of hatchery to wild ratios in the basin because it does not account for hatchery fish removed at the hatchery trap.</p>
	Cole M. Rivers Hatchery Trap	<p>Both abundance and hatchery to wild ratios are measured at the hatchery trap. The trap is clearly biased toward hatchery fish in that from 50% to 90% of the hatchery fish counted at Gold Ray Dam are collected in the trap while only 6% to 12% of the wild (unmarked) fish counted at the dam were taken at the trap. All of the fish collected at the trap can be removed from natural spawning. This is excellent for management, and the data can be used in combination with other data to estimate abundances and ratios elsewhere in the system.</p>

Table 2 cont. Program for Monitoring Hatchery to Wild Ratios in the Rogue Basin. Figure 6 also provides a map of the locations.

Type of Monitoring Site	Specific Locations	Description
Spawning Ground Counts	Big Butte Creek Diversion	This facility is located in Big Butte Creek just below the falls. There is not much natural spawning habitat above this site because of the falls; however, the falls has a ladder that can pass coho and may also pass fish at high flows. The areas below the diversion are used by coho. Only a small number of the coho in Big Butte Cr. would be expected to be trapped at this location, but it may be enough to provide a hatchery to wild ratio for the area. This facility is not currently used for monitoring. Some facility evaluation and construction would be needed to make it useable.
	Areas below Gold Ray Dam:	Hatchery to wild ratios can also be monitored by collecting or observing carcasses during spawning ground surveys. The design of the spawning ground surveys is focused on providing an estimate of abundance; collection of hatchery marks is secondary. However, as long as the density of the monitoring locations is adequate, the ratios collected, taken as an average across all locations within each wild population, should provide a good measure of hatchery to wild ratios. A major limitation to this method is that the sample sizes tend to be small.
	Evans Cr., Applegate, Illinois	Spawning ground counts have not been conducted in the Rogue Basin historically. The first counts were conducted in 1996 in the Illinois and Applegate Basins. Counts in 1997 expanded to additional locations. Hatchery to wild ratios measured from those counts were:
	Areas above Gold Ray Dam:	<p>Illinois Basin: 1996: Sample size: 41 Ratio: 5% hatchery fish* 1997: Sample size: 90 Ratio: 0% hatchery fish</p> <p>Applegate Basin: 1996: Sample size: 31 Ratio: 16% hatchery fish 1997: Sample size: 39 Ratio: 3% hatchery fish</p> <p>Canyon to Gold Ray Dam: 1997: Sample size: 178 Ratio: 0%</p> <p>Above Gold Ray Dam: 1997: Sample size: 81 Ratio: 1% hatchery fish</p>
Trail Cr. Little Butte Cr. Additional areas that could be added in the future include several locations in Big Butte Cr., Elk Cr. and the mainstem Rogue below the hatchery. Exploration of the Rogue Basin will continue to locate additional natural production areas; additional monitoring locations may be added as they are located.	*based on scales only; all others are based on mark recaptures	

Figure 1.
 Map of the Rogue River Basin
 Showing Locations of Wild Populations,
 Hatchery Facilities and Landmarks



ODFW 9/93
 MAP 6A-1

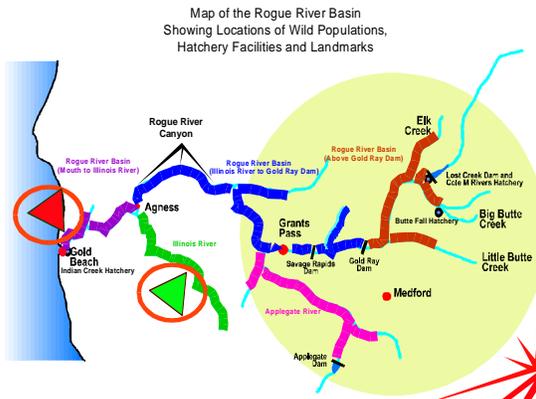


Figure 2.
Map of the three upper
Rogue Basin populations
that are most likely to be affected
by Cole Rivers hatchery strays.
Existing and proposed
monitoring locations are identified.

