SALMON AND STEELHEAD RUNS, 1950 TO PRESENT

INTRODUCTION

In 1950, salmon and steelhead runs to the Sandy River faced many obstacles to production. Operations at Marmot Dam continued to hinder upstream and downstream migrations and limit production in the lower Sandy River. Salmon and steelhead access to significant historic habitat areas in the Bull Run drainage — possibly exceeding the Salmon River in fish production potential — remained blocked by Headworks Dam on the Bull Run River and a diversion dam on the Little Sandy River. Water withdrawals in the lower Bull Run and Little Sandy rivers curbed fish production in the lower river reaches. In addition, hatchery operators continued to collect large numbers of salmon and steelhead eggs in the basin.

Portland General Electric made several improvements at Marmot Dam after 1950 to improve fish passage. In 1951, the company began operating screens in the Sandy River diversion canal at the Oregon Fish and Game Commission's request. The screens were designed to prevent downstream migrants from entering the canal and being carried to Lake Roslyn, which had no outlet for fish except through the penstock and turbines. Studies by the Oregon State Game Commission in the early 1950s indicated that the screens were effective with regard to fish several inches in length — and had considerably reduced losses of seaward migrants — but were less successful in diverting fry or small fingerlings (Mattson 1955). This system was improved repeatedly during the following years. The fish ladder at Marmot Dam was also rebuilt several times after 1955 to ease upstream migration. Other gains for salmon and steelhead came in 1973 when the company began maintaining minimum streamflows below Marmot Dam. Then, in 1989 the company eliminated many remaining fish passage problems when it rebuilt Marmot Dam, a 60-year-old wood crib rock-filled structure, with a new concrete dam.

Fish returning to upper basin spawning and rearing grounds during this period, however, did not necessarily find the pristine conditions that had supported their ancestors. Timber harvest, road construction, urbanization, mining and other activities continued to spread along the lower Sandy and tributaries. After 1950, road construction and timber harvest in the upper Sandy watershed escalated and remained heavy through the 1980s. Other habitat damage resulted after the 1964 flood.

Fishing pressure also continued to affect salmon and steelhead production. Ocean and Columbia River harvest began climbing again in the 1950s, and expanded through the 1960s and 1970s as the declining

wild runs were replaced by hatchery production. Sport fishing on the Sandy River also rose steadily through the years.

FISH PRODUCTION

Generally, by 1950 salmon and steelhead runs in the Sandy River Basin had fallen to low levels. The following excerpts from Chester Mattson's report, *The Sandy River and Its Anadromous Salmonid Populations*, which was written for the Oregon Fish Commission in 1955 (Mattson 1955), may best describe the status of the runs in the early 1950s.

Spring Chinook "*During recent years the escapements into the mainstem and tributaries have not exceeded 1,500 spring chinook salmon. The calculated run up to the Marmot Dam during the spring of 1954 was in the neighborhood of 400 fish according to an Oregon State Game Commission report. In addition possibly 200 to 300 salmon had remained in the main river below. The range in recent years has been between 750 and 1,500 adult fish."*

Coho *"At present the (coho) runs probably do not exceed 2,000 to 3,000 adult fish, of which only a small and undetermined proportion spawn in the mainstem. Several hundred fish ascend annually above Marmot Dam and utilize areas of the upper watershed."*

Fall Chinook *"(Fall chinook spawning and rearing) has been limited in the lower 12 to 15 miles, more so with the dewattering of the main stem for 12 miles below Marmot Dam. Prior to the construction of this dam, several hundred fish had been observed within the lower several miles of the Salmon River. The maximum spawning escapement within the last eight years has been estimated at approximately 500 to 2,500 fish."*

Winter Steelhead *"In recent years considerable numbers (of steelhead), 2,200 fish in 1954, have ascended Marmot Dam and spawned in available areas above. Perhaps an equal number have utilized the suitable areas of the lower river below Marmot Dam."*

Data collected from a fish trap installed at Marmot Dam in 1953 provides further information about the runs after 1950. This data suggests that winter steelhead escapement above the dam increased after passage facilities were improved and egg-taking operations declined. Records from 1954 to 1958 show a five-year cumulative escapement of 11,241 winter steelhead passing Marmot Dam from March to June. About 97 percent (10,913) of the fish were determined to be wild (ODFW 1997). Winter steelhead escapement at Marmot Dam continued to increase in the early 1960s. From 1961 to 1965, the five-year cumulative escapement of winter steelhead passing Marmot Dam was 19,903 fish, of which about 75 percent migrated at the end of February (ODFW 1997).

Marmot Dam data, however, indicates that the basin's spring chinook and coho runs continued to drop for several years. Records show that spring chinook passage to the upper basin declined after 1950, sometimes dwindling near zero. A minimum of 336 adult spring chinook escaped annually to the Sandy River during the 1950s. This estimate reflects harvest in the lower basin and escapement at Marmot Dam. It does not include adult spring chinook that spawned in the lower river below Marmot Dam during this period. The dam counts fell to an average of 168 adults in the 1960s (ODFW 1997).

As discussed earlier, several factors contributed to these low returns. Trapping of adult spring chinook at Marmot Dam for hatchery brood stock continued through the 1950s. Many other adults were caught in commercial and sport fisheries in the ocean, Columbia River and lower Sandy River. In addition, reduced flows in the Sandy River below Marmot Dam until the 1970s may have restricted some adult spring chinook migration (ODFW 1997).

Conditions along the Sandy River and many tributaries — often already altered by road construction, timber harvest and other activities — changed again during and after the flood of 1964. At the flood's peak, the Sandy River contained about 82,000 cfs of flow at its confluence with the Columbia River. These high flows scoured and altered stream channels as they gushed through the watershed.

Post-flood channelization efforts boosted the damage. After the flood, the Army Corps of Engineers and local communities joined efforts and channelized several miles of the lower reaches of the Salmon, Zigzag and Sandy rivers and Still Creek. They channelized the Sandy River from the confluence with Clear Fork to the Sleepy Hollow area just upstream from the confluence with Alder Creek. The workers used heavy equipment to reconfigure and straighten the stream channels and remove most large obstructions and boulders from the streambeds. They built berms with rocks to contain the streambanks, destroying riparian vegetation along the streams and blocking many side channels.

While well intended, the channelization projects affected the timing, variability and duration of floodplain and wetland inundation in the area. They reduced biological productivity along the channelized stream corridors, and significantly degraded the quality of spawning and rearing habitat for native winter steelhead, coho, spring chinook, fall chinook, cutthroat and resident trout. The instream channelization work also lowered habitat complexity in the stream channels and blocked fish passage into many side channels that historically had provided substantial rearing and spawning habitat. These side channels and backwater areas had been especially important for winter-rearing juvenile anadromous fish, including juvenile steelhead, which would seek the slower velocities found in these areas and hide under large logs,

undercut banks and other protected areas. The projects also increased flow velocities within the channelized reaches, which scoured spawning gravels from the streambed (ODFW 1997).

As natural salmon and steelhead production dropped, however, hatchery production increased. In the 1950s and early 1960s, hatchery production programs became more successful as the operators acquired new knowledge about fish culture. Fish propagators began feeding fish better diets and using improved fish rearing and release strategies. They also learned more about disease prevention and treatment. As a result, the hatchery fish were healthier and had a better chance of surviving than those released in the early 1900s.

In 1950, the Sandy River Hatchery was constructed on Cedar Creek, about ½ mile above its confluence with the Sandy River. The hatchery prevented fish passage to about five miles of habitat in upper Cedar Creek, but boosted artificial production in the Sandy basin. Initially, the hatchery's operators relied heavily on eggs shipped in from Bonneville and other hatcheries for their production. The facility began operating in 1951 with 2,009,000 fall chinook eggs and 250,000 coho eggs from the Bonneville Hatchery, and 530,530 spring chinook eggs collected near Marmot Dam. In 1952, hatchery operators collected 135,030 spring chinook eggs near Marmot Dam and brought in nearly 8.5 million fall chinook eggs from the Bonneville and Oxbow hatcheries. It also received 294,000 coho eggs from Bonneville Hatchery (Mattson 1955).

From 1954 until the early 1960s, hatchery personnel worked to rebuild the runs using primarily Sandy River stock and reduced shipments of other stocks into the system. During the next few years, they continued gathering spring chinook eggs below Marmot Dam. In 1954, they collected fall chinook at a rack near the mouth of the Bull Run River at Dodge Park. Coho eggs were gathered at Cedar Creek (Mattson 1955). Hatchery operators again started receiving fall chinook eggs from other hatcheries in the 1960s. Coho and spring chinook production continued to rely primarily on Sandy River brood stock through the mid-1960s. Winter steelhead were also raised at the hatchery for several years to support an early winter sport fishery.

Table 3. Egg collection in the Sandy River Basin, 1950-1960[6] (ODFW 1997)

Site	Year	Spring Chinook[7]	Fall Chinook	Steelhead	Coho
Marmot Dam	1950	597,520			
	1951	530,530			
	1952	135,030			
	1953	175,105			
Cedar Creek	1953				196,425
Marmot Dam	1954	502,480			
Bull Run River	1954		92,865		
Cedar Creek	1954			118,765	716,000
Marmot Dam	1955	10,280			
Bull Run River	1955		134,220		
Cedar Creek	1955			119,711	
Cedar Creek	1956	84,385	(F+S mixed)	108,245	
Bull Run River	1956		438,485		
Cedar Creek	1957	1,619,650	(F+S mixed)	404,800	
Bull Run River	1957		290,810		
Bull Run River	1958		126,872		
Cedar Creek	1958			116,567	
Cedar Creek	1959	81,256	184,237		
Cedar Creek	1960		494,078	29,000	
Gordon Creek	1960		16,457		

Since the late 1970s, the state has used the Sandy Hatchery exclusively to raise coho. Production of fall chinook, spring chinook and steelhead at the hatchery ended in 1976, 1975 and 1974, respectively. Spring chinook production at the hatchery was hindered because low flows in Cedar Creek during the migration period kept many adult spawners from returning to the station (ODFW 1997). Coho releases at the facility grew from a release of 250,000 smolts the first year to about 500,000-800,000 smolts, and then stabilized at 1 million smolts until 1995 (ODFW 1997). Today the Sandy Hatchery is used to raise early-run coho with brood stock gathered from adult hatchery returns. Most of the coho are released on-station as smolts.

As discussed earlier, several actions initiated after 1970 improved fish production in the basin. In 1973, Portland General Electric began maintaining minimum streamflows in the Sandy River below Marmot Dam to provide spring chinook and other fish with adequate water for upstream migration in summer and fall, and to support spawning and rearing below the dam. The company also adjusted flow diversions to reduce wide fluctuations in lower river streamflows and continued improving conditions at the dams to

6 Table includes data from several reports (Mattson 1955, Wallis 1966, Collin 1974, Pirtle 1953, Craig and Suomela 1940). Some discrepancies between reports exist.

7 Some mixing of fall and spring chinook eggs is possible.

enhance upstream and downstream fish migration. Further, the Forest Service, Bureau of Reclamation and others began improving habitat conditions and otherwise undoing damages caused by past timber harvest and by channelization efforts following the 1964 flood.

Larger releases of hatchery fish contributed to the growth of sport fisheries in the Sandy River Basin and on the Columbia River. Fish managers boosted hatchery releases of winter steelhead in the late 1960s as natural steelhead escapement to the basin dropped and interest in sport harvest increased. Then they introduced summer steelhead to the Sandy River in 1975, creating a very popular fishery in both the upper and lower river. They also raised hatchery releases of spring chinook and coho during the 1970s. Spring chinook releases expanded again in the 1980s when state fish managers launched an aggressive program to supplement the declining native spring chinook run with Willamette stock from the Clackamas Hatchery. Portland General Electric and the City of Portland provided funds for this program to compensate the state for fish losses at the dams.

CURRENT RUNS

Today, large numbers of winter steelhead, spring and fall chinook, coho, and summer steelhead still return to the Sandy River. However, the proportion of wild fish in these runs has dropped considerably over the years. The current runs are discussed briefly below.

Winter Steelhead

The Sandy River consistently rates as one of Oregon's top 10 winter steelhead producers. In recent years about 10,180 winter steelhead returned each year to the Sandy River. This average run, including both hatchery and wild fish, was estimated at 10,179 for run years 1987-1988 to 1991-1992 based on harvest in the lower river and escapement over Marmot Dam. During this period, anglers caught an average of 7,563 winter steelhead and about 2,616 adult winter steelhead escaped annually to upper basin spawning grounds. More recently, the number of adults passing Marmot Dam has ranged from a high of 2,918 fish for the 1991-1992 run year to a low of 537 fish for the 1995-1996 run year. Winter steelhead passage at the dam then increased, reaching 1,426 fish in the 1996-1997 run year (ODFW 1997).

Virtually every passable reach of the basin contains winter steelhead spawning habitat. In the upper basin, good winter steelhead production exists in the Salmon River system below Final Falls, and in Still Creek and many small upper basin tributaries. Production also occurs in turbid stream reaches such as the Muddy Fork of the Sandy River, the upper Sandy River and the Zigzag River where glacial flour is evident. Many steelhead also spawn and rear in the lower basin. Recent surveys show significant

spawning in the lower Sandy River. However, little is currently known about winter steelhead populations in the lower basin (Cramer, personal communication 1998).

Information collected at Marmot Dam and from anglers suggests that the basin's wild winter steelhead run has declined over the years. Consequently, the National Marine Fisheries Service recently listed the stock as "Threatened". The Oregon Department of Fish and Wildlife manages wild Sandy River winter steelhead as a Stock of Concern.

Fish managers are currently addressing factors that might be limiting wild winter steelhead production in the basin. Their concerns include the possibility that introductions and straying of hatchery fish above Marmot Dam may be influencing the wild run. Until 1963, primarily wild winter steelhead escaped over Marmot Dam. However, in 1964 hatchery operators started releasing hatchery steelhead above the dam and hatchery stock escapement to the upper river increased. From the early 1980s to the early 1990s, the percentage of natives in the Sandy's total winter steelhead run declined from 28 percent to 18 percent. This suggests that introductions and straying of earlier returning hatchery stocks may be influencing the wild run (USFS 1996; ODFW 1994). Releases of summer steelhead since 1975 to provide a summer fishery above Marmot Dam may also be affecting winter steelhead production if summer steelhead smolts compete with native winter steelhead for space and food. Further, increased trout angling pressure in the upper basin may have increased mortality of incidentally caught juvenile winter steelhead. Currently, hatchery managers are releasing hatchery-produced winter steelhead below Marmot Dam to reduce mixing between the stocks and competition for habitat in the upper basin.

Coho Salmon

The Sandy River Basin supports two coho stocks: a native late-spawning stock (November-February) and an early-spawning hatchery stock (September-November). The basin's native coho population generally spawns and rears in the clearwater tributaries above Marmot Dam, though some production also occurs in the lower basin. Studies show that coho salmon prefer areas with low water velocities, such as low gradient small and medium-sized streams, side channels and the margins of mainstem rivers (ODFW 1997).

The upper watershed contains many miles of suitable coho habitat, particularly in the Wild and Scenic River segments of the basin and/or within the bounds of wilderness areas. Primary habitat exists in the Salmon River and tributaries below Final Falls, and in Still Creek. The mainstem Sandy River and side channels also support some coho production (ODFW 1997).

Coho counts at Marmot Dam suggest that the native run is stable, but has recently declined. The counts averaged 1,201 adults and jacks annually for the 10-year period 1985 to 1994. However, estimated coho escapement at the dam declined to an average of 794 fish for the five-year period 1991 to 1995, ranging from a high of 1,492 fish in 1991 to a low of 220 fish in 1993 (ODFW 1997). Native Sandy River coho are listed as sensitive by the State of Oregon. The National Marine Fisheries Service considers the native Sandy River coho stock a candidate species for listing and plans to review its status in 2001.

The basin's early returning coho run is produced at the Sandy Hatchery from native Sandy stock. Hatchery operators release about 700,000 hatchery coho smolts annually into the Sandy River. These releases support commercial and sport harvest in the ocean and Columbia River fisheries and sport angling in the Sandy River.

Spring Chinook

The Sandy's spring chinook population has increased significantly over the last 15 years, primarily due to hatchery releases in the watershed. In the early 1970s, fish managers started supplementing natural spring chinook production with hatchery releases of Willamette stock smolts and pre-smolts. They expanded the releases in the 1980s. Currently, they release about 460,000 hatchery spring chinook smolts annually in the Sandy River. The estimated five-year average return for run years 1990 to 1994 was 5,118 fish.

Presently it is unknown whether the indigenous stock of Sandy River spring chinook has sustained itself as a separate subpopulation from the introduced Willamette stock (ODFW 1997). Genetic research is currently under way to learn if a wild Sandy River spring chinook stock exists. Meanwhile, since 1994 fish managers have tried to promote natural spring chinook production in the upper basin by releasing all hatchery spring chinook below Marmot Dam. Currently, the National Marine Fisheries Service is considering listing all wild lower Columbia River chinook, including wild Sandy River spring chinook, as Threatened.

Most naturally producing Sandy River spring chinook spawn in the upper watershed above Marmot Dam. Primary spawning areas include the Salmon River up to Final Falls (RM 14) and the lower three miles of Still Creek. Spring chinook also spawn in the Zigzag River, upper Sandy River and the lower reaches of several tributaries when flows permit. Generally, chinook salmon prefer large pools in low gradient areas within the mainstem and large tributaries. They are not usually found in smaller tributaries or side channels (ODFW 1997).

Summer Steelhead

In 1975, fish managers began releasing summer steelhead in the basin, creating a popular sport fishery. Past observations suggest that a small native run may have existed prior to these releases. For instance, in the 1950s (before hatchery releases were initiated) a few steelhead were found in the Bull Run River during September and October. A few steelhead were also counted passing Marmot Dam during these same months in the 1960s and 1970s. Managers do not know whether the fish were native to the Sandy River, strays from other lower Columbia River tributaries, or late-returning winter steelhead that had stayed in pools below the dam until flows for migration improved. Angling reports from the 1950s also show some steelhead being caught in the Sandy River (ODFW 1997).

Today, the summer steelhead run provides angling opportunities from April to December. The fish are currently released in the Zigzag, Salmon, and Sandy rivers. Until recently, they were also released in Still Creek. During the five-year period from 1989-1990 to 1993-1994, an average of 4,544 summer steelhead returned annually to the Sandy River. The run ranged from a high of 6,994 fish in 1992-1993 to a low of 3,142 fish in 1993-1994. These returns reflect angler punch card data and Marmot Dam counts (ODFW 1997).

Fall Chinook

Sandy River fall chinook are divided into two runs — a wild late-maturing run and an early-maturing "tule" run. The wild late-maturing population is the dominant fall chinook run to the Sandy. The run is considered depressed but stable, and like all lower Columbia River chinook, is regarded as a sensitive species by the State of Oregon. The National Marine Fisheries Services is considering listing all lower Columbia River chinook, including wild Sandy River spring and fall chinook, as Threatened. The early-maturing tule run consists of a few to several hundred fall chinook that return each year to the Sandy River to spawn. These fish are believed to be remnants of hatchery releases made before 1977 or strays from other systems. No hatchery fall chinook have been released in the Sandy or its tributaries since 1976 (ODFW 1997).

Between 1984 and 1994, an average of at least 1,503 fall chinook returned to the Sandy River. This estimate, based on redd counts and sport harvest data, is considered a minimum run size. Actual spawning escapement to the basin was probably higher in most years since some spawning also occurs outside the standard survey areas. Fall chinook spawn in the lower Sandy River near Oxbow Park and in lower tributaries, including Gordon and Trout creeks. Like spring chinook, they generally prefer large pools in low gradient areas within the mainstem and large tributaries.

Resident Fish

The Sandy River Basin also contains several resident fish populations, including cutthroat trout, rainbow trout, whitefish, and brook trout. These populations are discussed briefly below.

Cutthroat trout are the most common trout species in the basin and are native to the Sandy River. Currently, the basin supports both resident and anadromous forms of cutthroat. Resident cutthroat trout are generally abundant in the Sandy's smaller and average-sized tributaries. Production of anadromous cutthroat in the basin is now believed to be very low, but reports by past anglers suggest that sea-run cutthroat once provided a significant sport fishery in the lower basin (ODFW 1997). Currently, fish managers only release hatchery cutthroat in the basin's isolated high mountain lakes.

Rainbow trout are also native to the Sandy River Basin. They are currently found in the mainstem and many larger tributaries throughout the watershed, including the Bull Run River. Rainbow usually reside below barriers to anadromous fish, but some tributaries also contain small populations above barriers. Until 1997, hatchery rainbow were released in several tributaries of the Sandy to provide angling opportunities. Since 1997 these releases have been limited to standing water bodies to protect the wild rainbow population.

Studies in the basin show that rainbow occasionally mate with cutthroat trout. During a genetics study conducted in 1994 and 1995, researchers documented hybridization between resident cutthroat and rainbow trout in some upper basin tributaries (ODFW 1997).

Mountain whitefish are indigenous to the Sandy River Basin. They reside in the Sandy River and most large tributaries. The basin's mountain whitefish population is considered healthy and stable.

Brook trout are not native to Oregon. They entered the basin during the late 1800s when they were released in several high mountain lakes and a few streams to provide angling opportunities. Recently, brook trout have been observed in Mud Creek above and below Trillium Lake. They are believed to be descendants from early hatchery releases in Trillium Lake. They have also been documented in the upper Salmon River and in the lower reaches of Ghost Creek. These populations probably originated from hatchery releases made in the upper Salmon River near Highway 26. In the past, brook trout have also been found in Camp Creek, a tributary of the Zigzag River, and in the Little Sandy River above RM 13.3. These brook trout populations are not being encouraged. Currently, flowing waters in the basin are managed to enhance native trout production (ODFW 1997).

SUMMARY

At the turn of the century, the Sandy River supported runs of spring chinook, fall chinook, coho, steelhead and chum. Today, except for chum, these fish still return to the river — though the runs are far below historic levels. Comparisons of records from an old hatchery within the Salmon River watershed, along with recent spawning surveys in the Salmon and Zigzag watersheds, suggest that current spawning returns are only 10-25 percent of 1890s levels, which were already reduced by decades of heavy fishing (USFS 1996). In addition, hatchery-produced fish now make up a large percentage of the basin's winter steelhead, coho and spring chinook runs.

As discussed previously, many factors have influenced salmon and steelhead production in the Sandy River Basin during the last 150 years, including;

- Overharvest in commercial and sport fisheries
- Habitat degradation from logging, agricultural practices, mining and road development
- Lost natural production from egg-take operations at various sites in the basin since the late 1800s
- Loss of historically significant habitat due to municipal water supply development in the Bull Run Basin
- Flow and fish passage restrictions from hydroelectric operations and diversions at Marmot Dam and the Little Sandy dam
- Habitat losses during and after the 1964 flood
- Competition from introduced hatchery fish.
- Habitat alterations due to naturally occurring fires and large climatic changes.

Now, efforts are under way to restore the basin's native fish populations while maintaining fishing opportunities inside and outside the Sandy River Basin. Fish managers are reviewing releases of hatchery winter steelhead, spring chinook, and coho to reduce competition between hatchery and wild fish. They are also restricting some angling opportunities, primarily in the upper basin, to protect the wild runs. At the same time, various public and private interest groups are working with basin habitat managers to improve spawning and rearing conditions in the upper basin above Marmot Dam. Projects are also ongoing to improve upstream and downstream fish migration past Marmot Dam and to reopen side channels and other lost historic habitat areas. Further, managers are examining opportunities to restore salmon and steelhead access to the upper Little Sandy River and Cedar Creek drainages and are weighing potential gains of such actions against the impacts on existing programs.

Several key events influenced the basin's salmon and steelhead runs after 1950, including the following:

Key Events and Developments After 1950

1950	Road development increases in upper basin to provide access to potential timber harvest areas.
1950	Sandy River Hatchery completed.
1951	Sandy river Hatchery begins operating.
1951	PGE screens Sandy River diversion canal and constructs juvenile bypass facility in the Marmot Dam diversion canal.
1955	Egg-taking operations at Marmot Dam cease. Salmon and steelhead runs regain access to upper basin habitat.
1960	Road development continues in the upper basin.
1961	Hatchery releases increased to rebuild coho runs in the upper watershed.
1964	Floodwaters scour and alter stream channels as they gush through the watershed. Channelization projects on the lower Salmon, Zigzag and Sandy rivers and Still Creek further reduced fish habitat in the basin.
1965	Winter steelhead escapement drops after rebounding since 1950. The drop is largely attributed to the flood and channelization efforts and/or overharvest.
1970	Spring chinook production in the basin increases substantially after fish managers start an aggressive hatchery production program.
1974	Minimum streamflows are maintained in the Sandy River below Marmot Dam to provide fish passage and increase rearing areas.
1983	PGE rebuilds the fish ladder at Marmot Dam and installs a fish counter.

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