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CATCH -AND-  
RELEASE FISHING  
A DECADE OF EXPERIENCE  
A NATIONAL SPORT FISHING SYMPOSIUM

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Catch and Release as a Management Strategy  
for Steelhead in British Columbia

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Abstract

In British Columbia the most frequent application of catch and release has been on heavily used steelhead streams in the populated southwestern management regions. Seven years of data compiled since the first broad scale implementation of catch and release on Vancouver Island in 1980 indicated that the regulation was effective in reversing declining catch trends but that recovery from the sharp initial reductions in licence sales and angler days was slow and mostly related to the recent availability of hatchery steelhead. Hooking mortality associated with catch and release angling was low and survival through spawning for released fish was normal.

Introduction

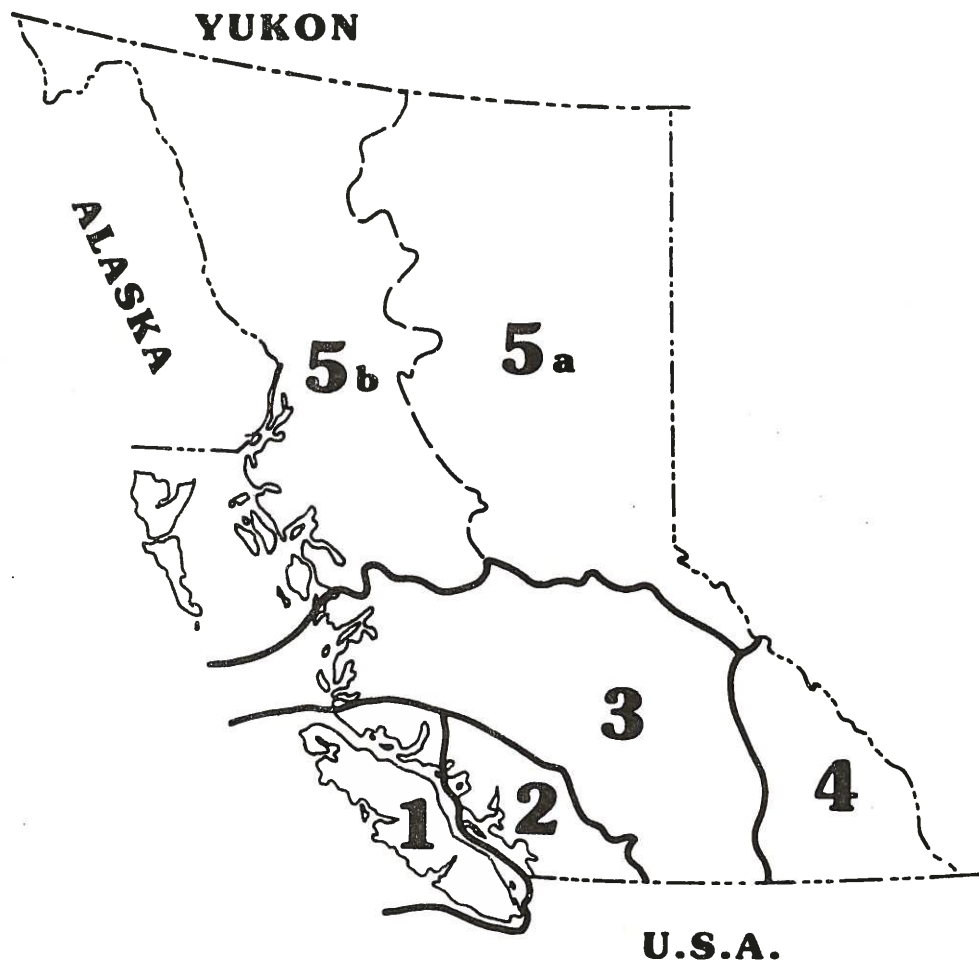
British Columbia with its thousands of miles of coastline contains a dazzling array of steelhead streams. Each year over 200 streams sustain some recorded angler effort and catch (Steelhead Harvest Analysis 1968-1987) while at least that many more support steelhead but are not fished. Streams range from smaller outer coast winter and/or summer steelhead producers to the large interior tributaries of major river systems such as the Fraser, Skeena, Nass, Stikine and Taku. Many of these latter tributaries—the Kispiox, Babine, Sustut, and Thompson—are world renowned for their exceptionally large, wild summer steelhead.

By fisheries management policy the steelhead streams of British Columbia are categorized as hatchery, augmented, or wild according to their natural ability to produce wild steelhead. With one exception the 22 augmented streams and 4 hatchery streams are located in the heavily populated southwest corner of the province. Wild streams, which clearly dominate the total provincial picture occur throughout the coast from the U.S. Border to southeast Alaska and in the interior (Fig. 1).

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A common feature of a large majority of British Columbia's steelhead streams is their low productivity. The smolt yield capacity is generally well below levels experienced in more southerly environments such as the Columbia basin, the historic center of steelhead abundance. Regulations governing steelhead harvest in British Columbia must therefore be relatively restrictive. Catch and release has become a major management tool to deal with low productivity streams and the cumulative effect on such waters of competing habitat uses, heavy sportfishing pressure and/or high exploitation by commercial and Indian food fisheries. Generally these streams are located in southwestern British Columbia in Management Regions 1 and 2 (Fig. 1). Most of the provincial data base associated with evaluation of catch and release has been compiled in Region 1 (Vancouver Island). For this reason the present report will focus on the Vancouver Island experience.



**Figure 1. British Columbia resource management regions. Steelhead regions include 1 (Vancouver Island), 2 (Lower Mainland), 3 (Thompson-Cariboo) and 5b (Skeena).**

## The Vancouver Island Study Area

### The Steelhead Fishery

Vancouver Island, a large coastal island adjacent to the heavily populated lower Fraser River valley, contains approximately 35% of the provincial total of streams which sustain measurable steelhead angler effort and catch annually. In recent years the Island has supported 20% of the days fished, 25% of the wild steelhead catch, and more than 60% of the hatchery steelhead catch for all of British Columbia (Steelhead Harvest Analysis, 1968-1987). In the 1986-87 season 5000 steelhead licences were sold to Island residents and angler days totalled 57,000.

Stream specific steelhead catches on Vancouver Island range from tens to thousands. Recently, more than half of the annual catch of 50-60,000 steelhead has occurred in only five streams and approximately 90% in not more than ten. The days fished pattern was similar. Hatchery steelhead are available in 11 streams but in most of these only since the early 1980's. Wild steelhead dominate the total angler catch.

### Regulations History

Regulations governing wild steelhead harvest were uniformly liberal across all of British Columbia from the earliest days of provincial fisheries management until the late 1970's. At that time, under the sponsorship of the Salmonid Enhancement Program, many first ever investigations of steelhead stock size and exploitation revealed the necessity for major reductions in daily and season catch limits. On Vancouver Island these reductions were scheduled to take effect in 1980. Further restrictions included catch and release only for all summer steelhead streams and a monthly limit to avoid chronic over-harvest of the early component of the winter steelhead run (Table 1).

Coincident with the agenda to introduce reduced catch limits in April 1980 came a disastrous winter steelhead season in 1979-80. This necessitated an emergency catch and release regulation which was subsequently included in the formal regulations from 1980-84 (Table 1). During the latter four years, hatchery programs were coming on line rapidly and anglers were provided the opportunity to harvest marked hatchery fish throughout the year. By 1985 hatchery production goals were realized and wild steelhead harvest was eliminated entirely.

Table 1. Summary of major regulation changes governing wild steelhead harvest on Vancouver Island streams, pre - 1959 to present.

Years	Steelhead Harvest Quotas			
	Per Day	Per Month	Per Year	Per River
Pre - 1959	3			
1959 - 1961	3		40	
1962 - 1976	2		40	
1977 - 1979	2		20	10
1980 - 1984*	1	2	5	
1985 - Present	0	0	0	

\*Further restriction included wild steelhead release Dec. 1 - Mar.1.

#### Evaluation of the Regulations

The objective of the wild steelhead catch and release regulation on Vancouver Island was to stabilize and, hopefully, reverse a steadily declining catch trend. Data were available from annual mailed questionnaire sampling of licences to compare effort and catch success in the "pre" and "post" catch and release years. These data provided a basis for assessing the efficacy of the regulation.

A common criticism of catch and release was that it was "unsafe" because steelhead subjected to such treatment would die or be weakened to a point where successful reproduction would not occur. To investigate these issues a study was designed to determine the mortality rate among steelhead caught and released on popular terminal tackle and to assess the spawning success of these fish relative to a control group. The research was conducted at Keogh River, an intensively monitored stream on northern Vancouver Island. Complete results of the Keogh study will be reported separately but important features are included here. A further indication of the consequences of catch and release was available from records on steelhead angled for brood stock for hatchery programs.



## Results and Discussion

### Angler Participation and Catch

The immediate response of anglers to the wild steelhead catch and release, first imposed mid-way through the 1979-80 winter steelhead season, was a 50% reduction in days fished (Fig. 2). In the following licence year (ending in 1981) there was a similar decline in the number of licences sold (Fig. 2). The number of days fished remained at historic lows for three years after which a strong upward trend developed. By 1985 the pre-catch and release angler days total was surpassed (Fig. 2). Licence sales, though increasing remained 20% below the pre-regulation level (Fig. 2). These data indicated that under catch and release angling effort increased from an average of 10 days per licencee to 12.

Retrospective analysis of the circumstances surrounding initiation of catch and release in 1980 left a clear impression that the need to acquaint licencees and the supporting services industry with the full rationale for catch and release was underestimated. If a professional public relations capability had been employed to sell the catch and release concept, the observed declines in licence sales and days fished would likely have been far less dramatic.

Licence sales and days fished over the 1983-87 period was undoubtedly influenced by the rapid growth of the hatchery steelhead program. The extent of this influence as opposed to a growing acceptance of catch and release is unknown but evidence presented below suggests the availability of hatchery steelhead was the dominant factor.

The number of wild steelhead retained by Vancouver Island anglers displayed a declining trend for more than a decade before any catch and release restrictions (Fig. 3). This was due, in part, to growing perceptions of some anglers that their ability to harvest fish had been underestimated, that the regulations were too liberal, and that steelhead abundance was declining. The total catch of wild steelhead over the 1971-79 period strongly supported a declining abundance theory (Fig. 4).

In the years 1980-84 the seasonal catch and release regulations reduced the wild steelhead kill to approximately one third of the preceding three-year average. This was followed by a further decline after 1985 when year round catch and release came into effect (Fig. 4). The fact that some wild steelhead kill was reported in those years when harvest was illegal probably resulted from errors in catch reporting, misidentification of hatchery fish and/or deliberate non-compliance.

Total catch of wild steelhead increased sharply during the catch and release period and remained well above previous peaks (Fig. 4). Tagging studies revealed that a substantial portion (>30%) of the increase could be attributed to repeat captures (Hooton and Lirette 1986; Hooton 1979; unpublished Fish and Wildlife Branch data). It must be noted, however, that

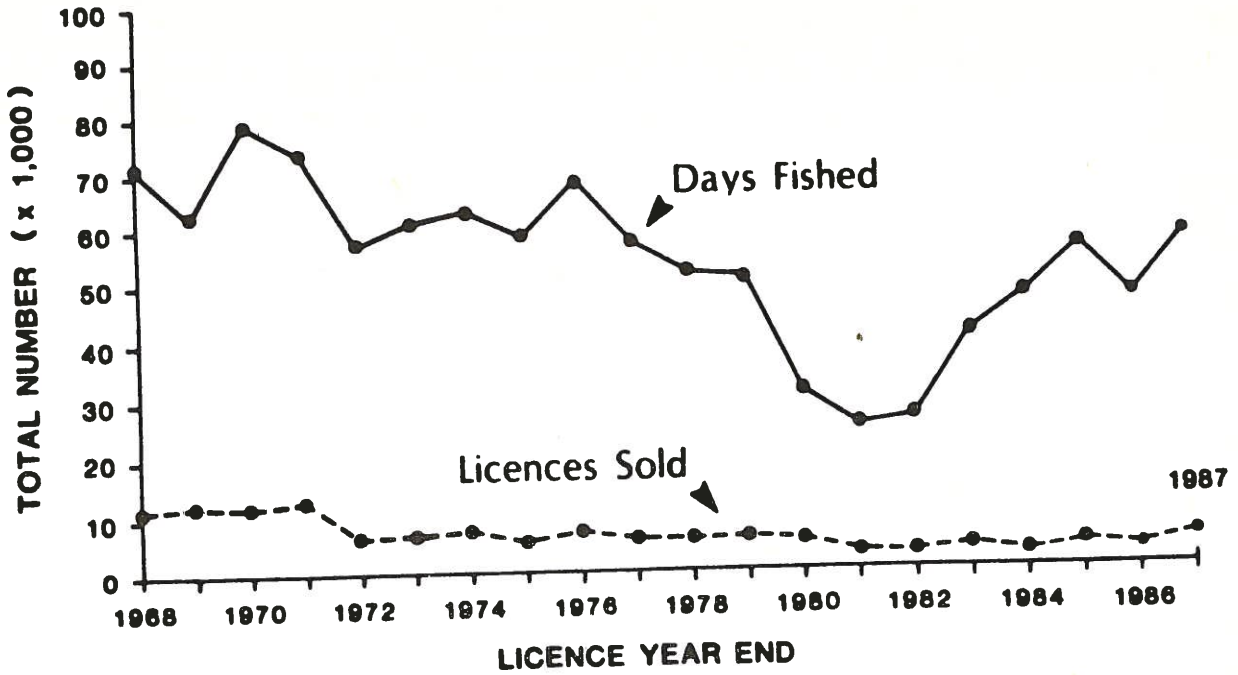


Figure 2. Number of days fished and steelhead angling licences sold, Vancouver Island, 1968 through 1987.

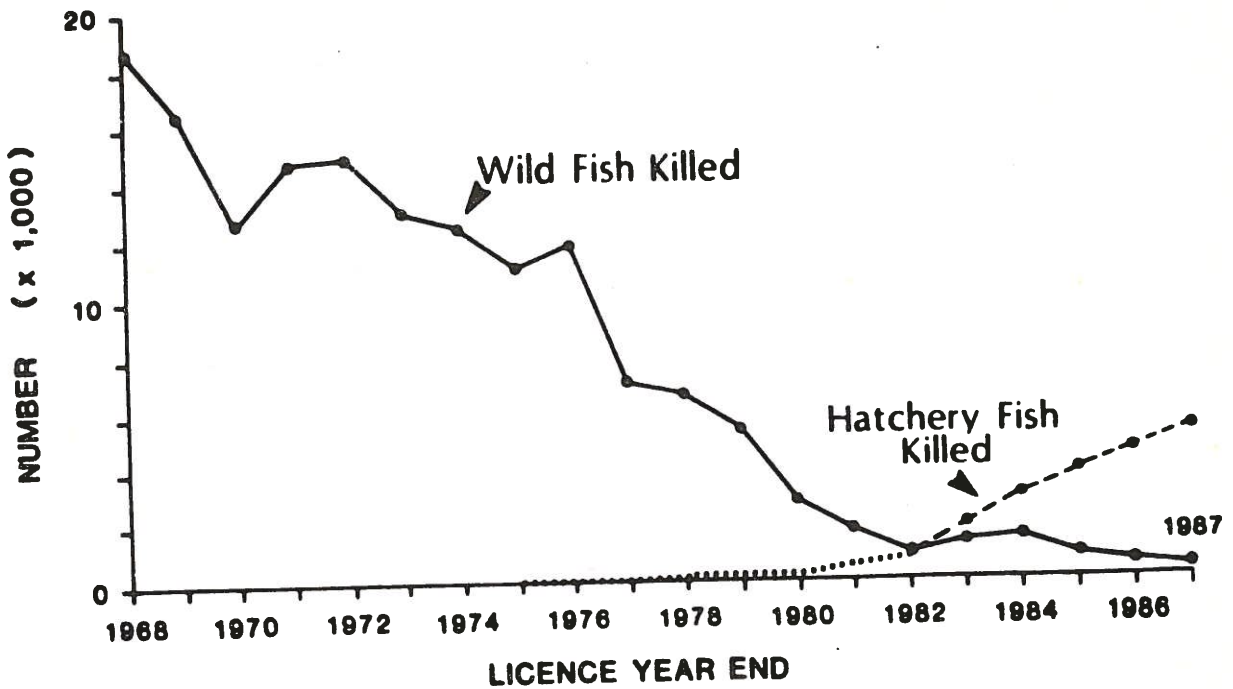


Figure 3. Number of wild and hatchery steelhead killed by anglers on Vancouver Island streams, 1968 through 1987.

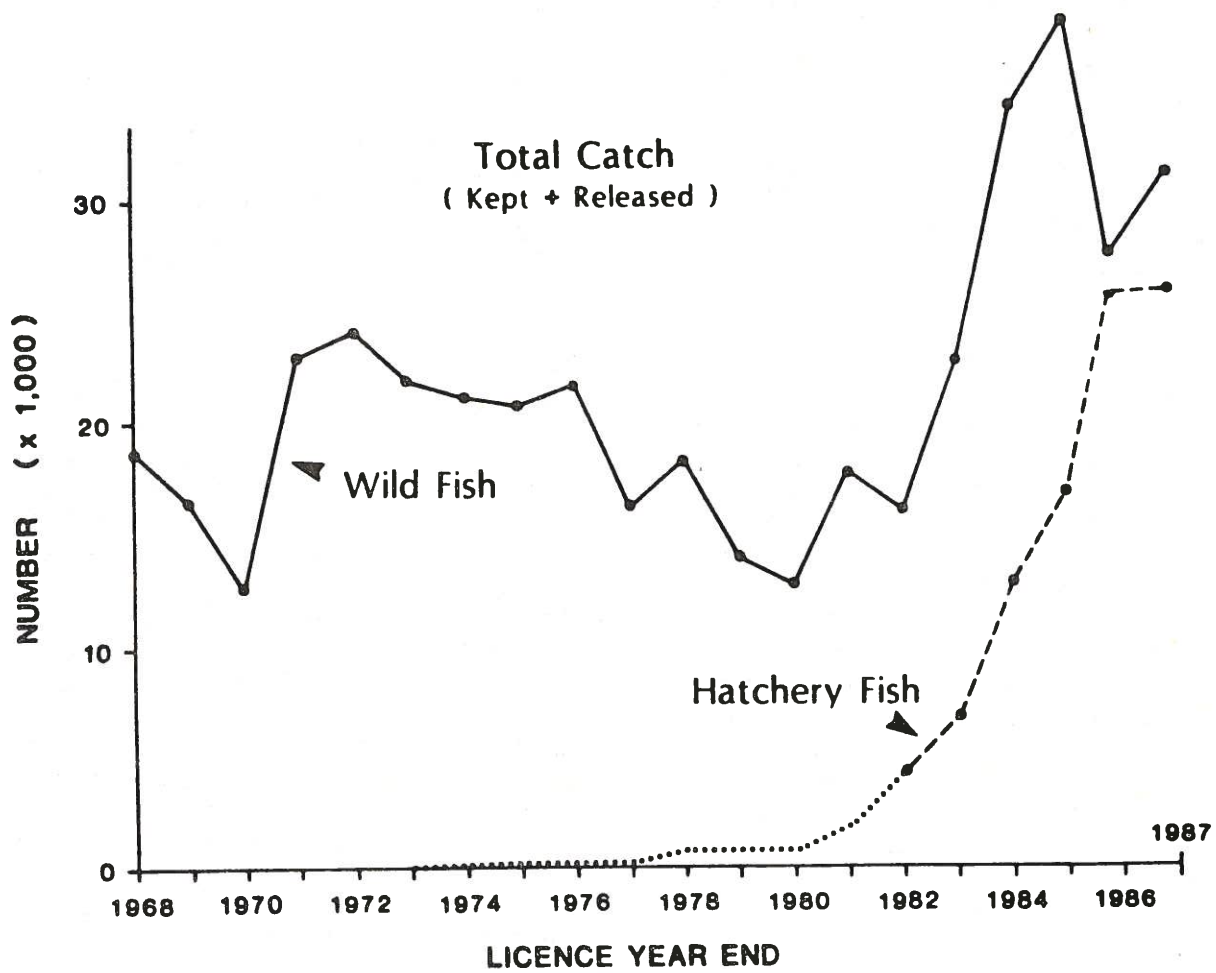


Figure 4. Total angler catch (kill and release) of wild and hatchery steelhead on Vancouver Island streams, 1968 through 1987.



catches were also responsive to an unusually high abundance of wild steelhead in 1984 and 1985, a phenomenon that was observed elsewhere in British Columbia and throughout the steelhead range.

The response in wild steelhead recruitment from increased escapements which followed catch and release has not been measured and, in fact, could not be separated from environmental influences and the contribution of hatchery adults which spawned naturally. However, the subjective interpretation of the author is that wild steelhead recruitment (i.e. abundance and catch) will continue to fluctuate annually in response to these other variables but at a substantially higher level than would have occurred in the absence of catch and release.

Angler preference studies conducted on Vancouver Island in the mid 1970's determined that, under the circumstances of the day (i.e. liberal catch limits, relatively stable total catch, little hatchery production) catch and release was not a popular regulations option (Hooton 1982). Empirical evidence from the catch and release period confirmed that attitude despite changes in wild steelhead stock status and increasing hatchery steelhead availability. At Gold River, the most prolific wild steelhead only stream in the region, angler days were declining during the 1976-79 period (Fig. 5). The decline continued through 1980 when catch and release came into effect. However, despite catch and catch per unit effort figures which reached record highs in the 1983-87 period, angler days remained well below previous levels (Fig. 5). In contrast, the experience on four popular steelhead streams where anglers had the option of fishing for both hatchery and wild steelhead, the number of angler days and the percent of the total Vancouver Island steelhead angler days increased steadily through the pre and post 1980 period as the supply of hatchery steelhead increased to target levels (Fig. 6). Clearly, the pattern has been one of relatively low and stable angling effort on "wild" streams and deflection of anglers toward "augmented" streams where harvest opportunity remained.

#### Hooking Mortality and Spawning Success

The opinions that released steelhead die or do not spawn successfully, commonly heard from critics and opponents of catch and release, were refuted by data compiled from hooking mortality studies. Among 3715 steelhead angled on conventional tackle (bait, barbed hooks) to provide brood stock for hatchery programs, only 127 (3.4%) mortalities occurred (Table 2). A large majority of these fish subsequently survived the stress of frequent handling, transport, and lengthy confinement in hatchery facilities before maturing and being spawned. Virtually the entire Vancouver Island (and elsewhere in British Columbia) hatchery steelhead program was built around and continues to operate with these procedures.

At Keogh River where hooking mortality was studied more rigorously, similarly high survivals were noted. Among 336 steelhead angled on various combinations of popular terminal gear (Table 3) the mortality for the combined samples was 5.1% (Table 4). Use of natural bait produced higher

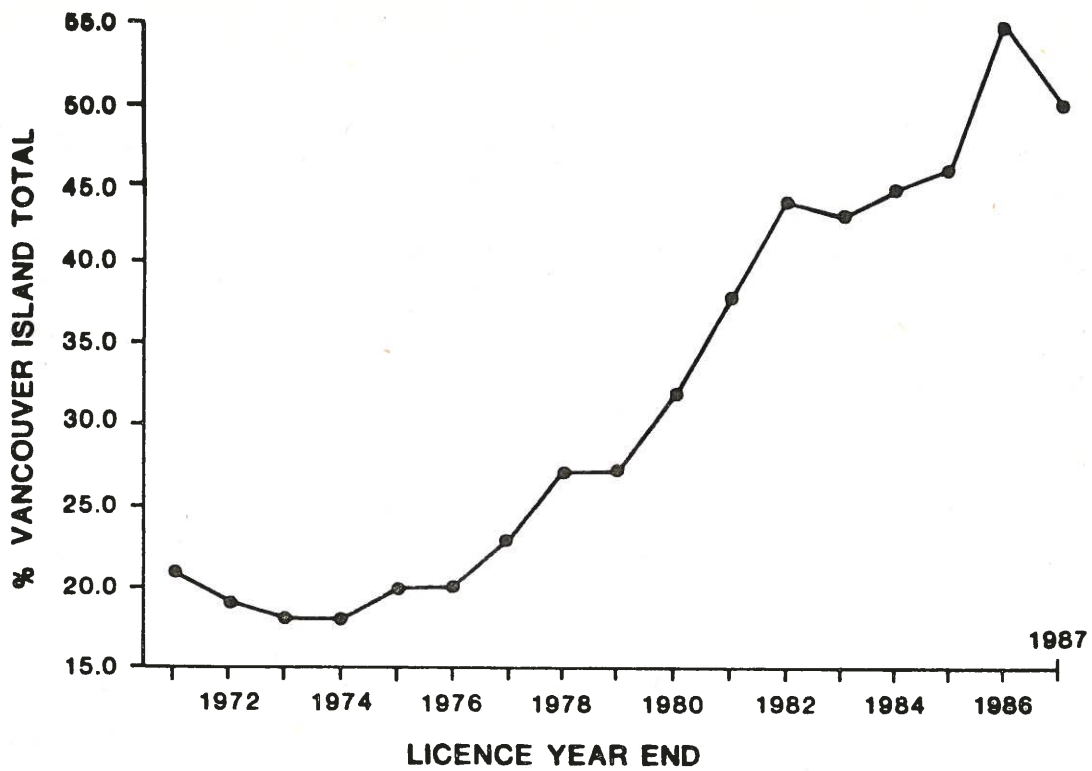


Figure 5. Percent of total Vancouver Island steelhead angler days expended on four popular hatchery steelhead streams, 1971 through 1987.

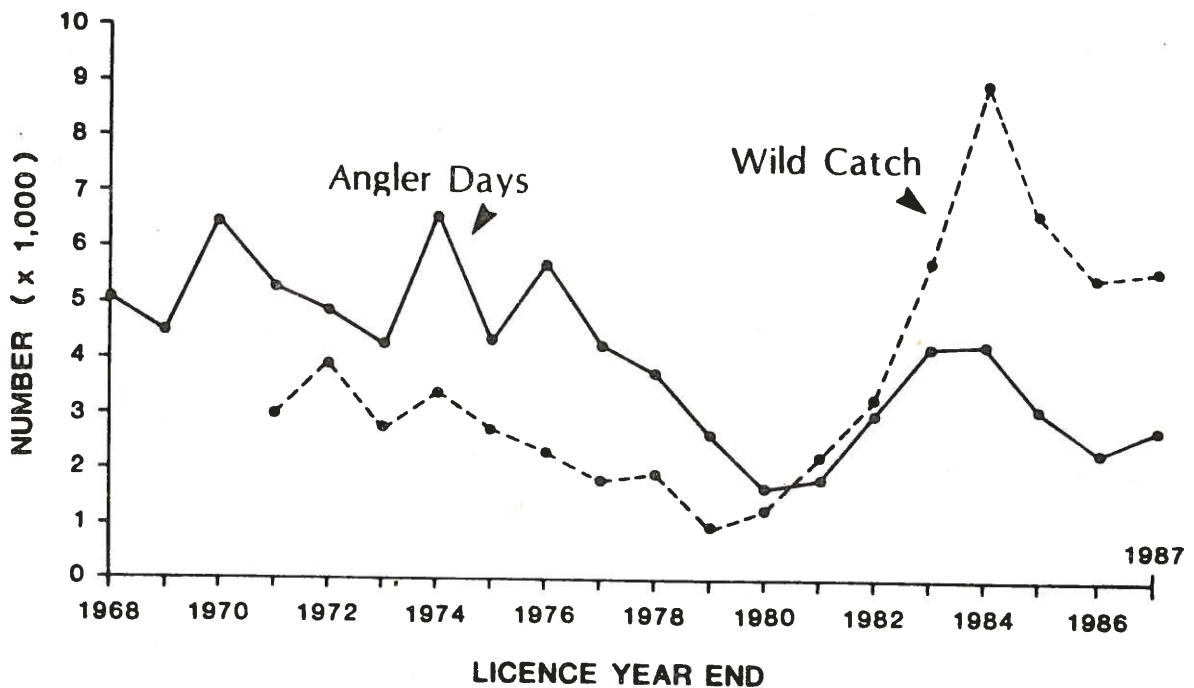


Figure 6. Number of steelhead angler days and total wild steelhead catch (kill plus release), Gold River, 1968 through 1987.

mortality (5.6%) than did artificial lures (3.8%) (Table 4). Also, mortality while using barbed hooks was higher (7.3%) than for barbless hooks (2.9%) regardless of whether bait or artificial lure was employed (Table 4). Analysis of the number of steelhead landed per hour fished on each gear combination indicated that bait was approximately 60% more efficient than artificial lure. This figure was probably minimal, however, because a high proportion of the angling sessions commenced with artificial lures and the number of catchable fish was likely much reduced before bait was employed.

Table 2. Stock specific hooking mortality among steelhead angled for brood stock purposes, Vancouver Island, 1981 - 1987.

Stock	Years of Record	Number of Steelhead Angled	Number (Percent) Hooking Mortalities
Cowichan	7	509	16 (3.1)
Englishman	5	240	9 (3.8)
Heber	1	70	3 (4.3)
Gold	1	30	0 (0)
Nanaimo	7	378	7 (1.9)
Puntledge	7	481	9 (1.9)
Salmon	6	464	27 (5.8)
San Juan	2	49	3 (6.1)
Somass	7	1174	43 (3.7)
Tsitika	7	320	10 (3.1)
All	N/A	3715	127 (3.4)



Table 3. Number of steelhead captured on various terminal gear types, Keogh River hooking mortality study, 1985 and 1986.

Year	Gear Type*								
	BB	BA	NBB	NBA	All	BB + NBB	BA + NBA	BB + BA	NBB + NBA
1985	48	26	56	0	130	104	26	74	56
1986	51	40	77	38	206	128	78	91	115
1985 + 1986	99	66	133	38	336	232	104	165	171

\* BB = barbed hook, bait  
 BA = barbed hook, artificial  
 NBB = barbless hook, bait  
 NBA = barbless hook, artificial

Table 4. Number (percent) of hooking mortalities on various terminal gear types, Keogh River, 1985 and 1986.

Year	Gear Type								
	BB	BA	NBB	NBA	ALL	BB + NBB	BA + NBA	BB + BA	NBB+ NBA
1985	6(12.5)	2(7.7)	2(3.6)	0(0)	10(7.7)	8(7.7)	2(7.7)	8(10.8)	2(3.6)
1986	3(5.9)	1(2.5)	2(2.6)	1(2.6)	7(3.4)	5(3.9)	2(2.6)	4(4.4)	3(2.6)
1985 +1986	9(9.1)	3(4.5)	4(3.0)	1(2.6)	17(5.1)	13(5.6)	4(3.8)	12(7.3)	5(2.9)

The survival through spawning of angled and released Keogh River steelhead was similar to that of steelhead which were captured at a weir at the same location 400 m. upstream from the ocean. The number of steelhead caught immediately downstream from the weir, tagged, released immediately upstream, and later trapped as emigrating post-spawners represented 27.5% of the available population. This was only 5.4% lower than the recovery rate for fish which were not angled (Table 5). This margin may have been attributable to additional handling stress endured by the angled fish.

Comparison of the degree of hooking injury with mortality rates revealed, not unexpectedly, that mortality was highest among fish which sustained severe blood loss when the hook pierced or tore a major blood vessel (Table 6). An instructive feature of the data was that, despite extensive blood loss, 47% of the most seriously injured fish recovered and were released in what appeared to be a healthy condition (Table 6). Interestingly, while the number of fish in the most severe injury groups (i.e. categories 2 and 3) was small, their recovery as post-spawners did not differ substantially from the least injured fish. Again this refuted claims that caught and released steelhead were effectively lost from the population.

### Conclusions

1. Catch and release is an effective mechanism for maintaining angling opportunity without negatively impacting stock recruitment.
2. A significant proportion of the angling public does not participate in purely catch and release fisheries, especially in the absence of any organized, advance promotion of such regulations.
3. Blanket catch and release restrictions are not necessary on some relatively healthy and/or remote wild steelhead streams (stocks) on Vancouver Island. However, relaxation of the existing regulation on a small number of streams would concentrate anglers and increase harvest beyond tolerable limits, thus re-creating the circumstances which demanded catch and release initially. The management strategy on these exceptional streams must therefore be rigidly enforced stock specific harvest quotas.
4. Catch and release management of wild steelhead stocks will become an increasing biological necessity in British Columbia as competing user groups strengthen their claims to the resource, as the stream habitat base is eroded by the inexorable forces of population growth and resource development, as angler efficiency increases, and as lobby pressures demand. The Fish and Wildlife Branch will be required to play an advocacy role in this evolutionary process.

Table 5. Number (percent) of hooking mortality study (HMS) and non-hooking mortality study (NHMS) steelhead recovered as emigrating post-spawners, Keogh River, 1985 and 1986.

Year	HMS Fish Recovered as Kelts	NHMS Fish Recovered as Kelts
1985	25 (22.3)	56 (24.03)
1986	59 (30.6)	403 (34.7)
1985 + 1986	84 (27.5)	459 (32.9)

Table 6. Number (percent) of hooking mortalities among steelhead of various hook injury categories and the percent of individuals of each category recovered as emigrating post-spawners, Keogh River, 1985 and 1986 data combined.

Hook Injury*	Fish Landed	Hooking Mortalities (%)	Potential Spawning Population	Number (Percent) Post-Spawners Recovered
1	257	0(0)	247	51(20.6)
2	49	1(2.0)	44	7(15.9)
3	30	16 (53.3)	14	4(28.6)
All	336	17 (5.1)	305	84(27.5)**

\* 1=Superficial wound, no blood loss  
 2=Moderate wound, some blood loss but no major blood vessel ruptured  
 3=Severe blood loss associated with rupture of major blood vessel

\*\* Includes 22 HMS kelts which had lost tags.



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### Literature Cited

- Anon. 1968-1987. Steelhead Harvest Analysis. Ministry of Environment and Parks, Victoria, B.C.
- Hooton, R.S. 1979. Preliminary report of a tagging program designed to investigate certain elements of the Campbell/Quinsam steelhead fishery. MS Rep., Ministry of Environment and Parks, Nanaimo, B.C.
- Hooton, R.S. 1982. A questionnaire survey of Vancouver Island steelhead anglers' opinions and preferences on management issues. Master's thesis. University of Idaho, Moscow, Idaho.
- Hooton, R.S., and M.G. Lirette. 1986. Telemetric studies of winter steelhead, Gold River, 1982-83. Ministry of Environment and Parks, Fish. Mgmt. Rep. No. 86, Victoria, B.C.

