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Terminal Area Troll Chinook Harvest Study
Final Report to the Fleet -1992

Few fish and lots of boats — the 1992 Carroll Inlet fishery was a bust. It wasn't just the Inlet, all of the wild and hatchery king returns in southern Southeast were abysmal. This was no consolation to the scores of trollers who crowded Ketchikan in response to our previous reports of the big bucks to be made catching terminal area hatchery king salmon.

Michael Round (F/V *Cheri Marie*) and I (F/V *China Cove*) completed our third and final season of experimental trolling in Carroll Inlet. Our total catch was only 124 king salmon, many of which were dark, ugly, and worth only 50 cents per pound. It's hard to make a profit on $10 king salmon. Fortunately, for me and Mike, our research was funded by a grant from the Alaska Science and Technology Foundation.

Our financial parachute, though, did not cheer the other trollers waiting for a few thousand mature king salmon to return to the "remote release site" managed by the Southern Southeast Regional Aquaculture Association. The trollers came early, but the fish straggled home late. Nobody was pleased.

The two previous years had been very successful. During 12 days of trolling in 1990, and then 22 days in 1991, Mike and I had learned a lot and had earned a fair amount of money. Two prior "Reports to the Fleet" describing our experimentation have been published in the *Alaska Fisherman's Journal.*

These reports attracted the attention of Joseph Orsi and Adrian Celewycz, salmon researchers from the Auke Bay Laboratory of the National Marine Fisheries Service (NMFS), who proposed that our research be augmented with "biotelemetry." On June 13, near Brunn Point, four mature king salmon were equipped with finger-sized "sonic tags" (which cost $500 each) that enabled us to track the fish via an underwater hydrophone connected to a wheelhouse receiver.

Some results of this pilot study will be used in this Report. Additional information has been published ("24 Hours in the Life of a Mature King Salmon") in the December 1992 issue of the *Alaska Fisherman's Journal.* A more complete account ("Tracking King Salmon in the Marine Waters of Southeast Alaska") will be published by the National Marine Fisheries Service early in 1993.

One unpublished detail from our biotelemetry efforts is the outcome of my very unofficial "seal bomb" test. Seal bombs are large weighted firecrackers that are used by some trollers to deter sea lions which steal hooked salmon. In my experience, these underwater explosions do not seem to inhibit nearby salmon from striking lures. We were able to explore this hypothesis during the sonic tracking of a tagged king in the lower Inlet. I dropped over a seal bomb while the salmon, in a rare period of inactivity, was drifting close to the boat about 10 fathoms down. We were unable to detect any response -- vertical or horizontal movement -- which would indicate that the salmon was startled or distressed by the explosion. A couple minutes later the seemingly undisturbed fish continued its wandering ways.

Meanwhile, Mike continued our trolling research. During the course of the project, information about every lure that we used and every fish that we caught was noted in daily logs. The extensive data from these logs was entered later into several computer databases.

Up to 23 informational "fields" were logged into the Lure database for each of the 4,692 lure "records" from the many different lures that we tested in Carroll Inlet since 1990. From this data we were able to compute additional information, such as CPUE (catch-per-unit-of- effort) and Lure Hours (one lure fished for one hour).

More than 35,000 Lure Hours were logged during the project. Some lures stayed in the water for only a few Lure Hours, while 22 lures were tested for more than 500 Lure Hours. In the three seasons, Mike and I landed 793 king salmon from exactly 100 lures -- 23 of these lures caught 10 or more kings each, but 36 lures caught only one king apiece.

There were 17 fields entered into the King database for each of the recorded fish. Only seven percent (54) of these 793 kings were immature "feeders;" the remaining 739 were mature salmon preparing to spawn. Slightly more than 50 percent (402) were females. We also caught 10 cohos, two pinks, and two chum salmon.

Without doubt, the returning kings were harvested from shallower depths than most trollers expected. Even though these fish generally were found somewhat deeper in 1992 than in the previous years, in all three seasons our best catches came from lures fished at an 8-fathom depth. More than 88 percent of the mature king salmon were caught at 12 fathoms or above.

This relatively shallow distribution was confirmed with the sonic tracking study. The biotelemetry showed that the four tagged fish resided primarily in the top 10 fathoms of the water column. This behavior may be related to the salinity or temperature levels near the surface. These maturing salmon are undergoing a physical transformation that will allow them to migrate into freshwater. It is possible that an extended stay in a saltwater/freshwater mixing zone is an essential component of this process.

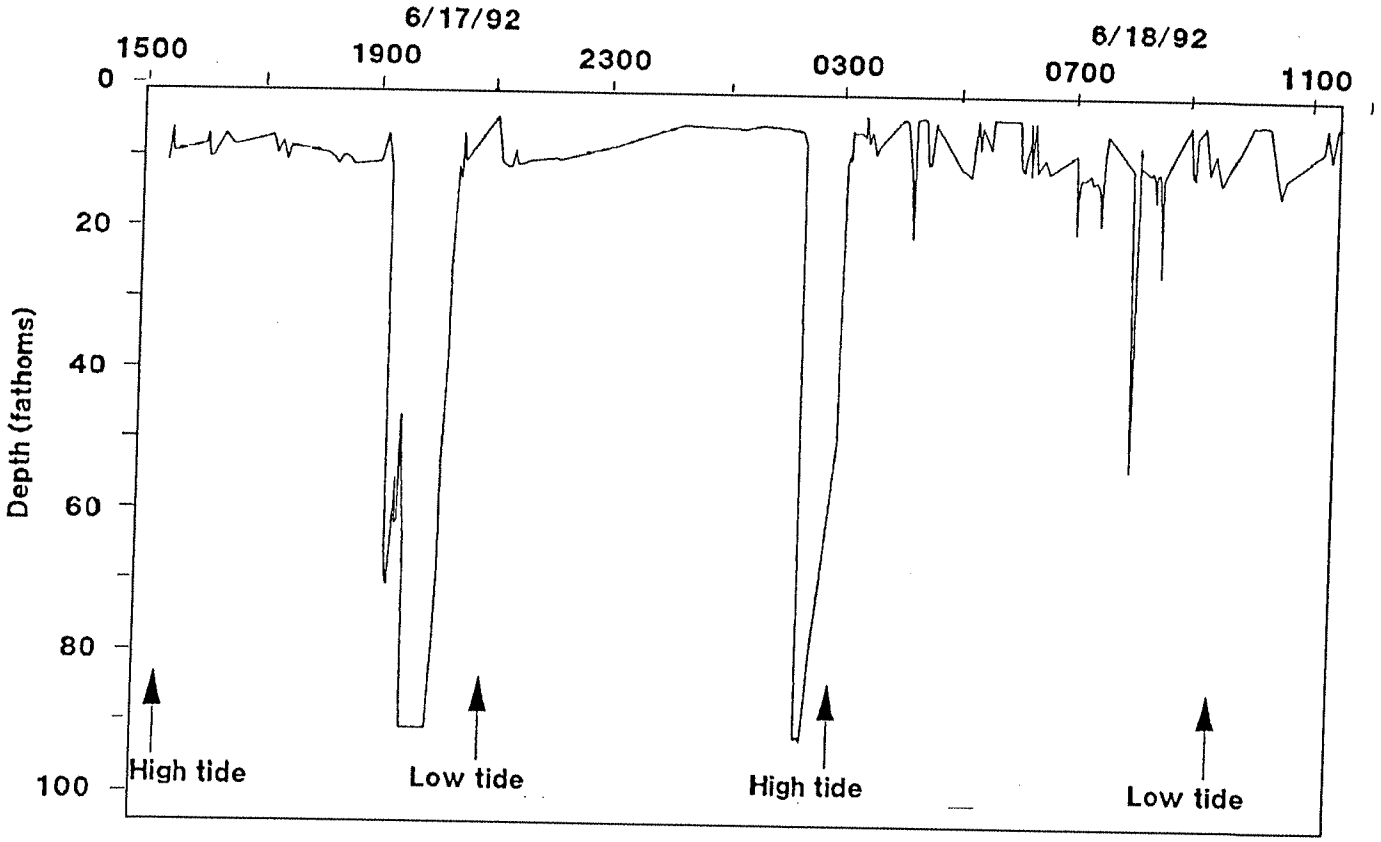
Oceanographic measurements taken in 1992 by the NMFS scientists showed that the halocline and thermocline zones (depths at which the salinity and temperature gradients are at their maximum) in the Inlet extended from near the surface down to about 15 fathoms. It is reasonable to speculate that the yearly depth of this mixing zone might determine the range in which the majority of the hatchery kings will be harvested.

The sonic tags also produced surprising confirmation of a deep-diving hypothesis that we first had considered during the 1990 season. On some days, the fish seem to disappear. All of the standard visual and electronic signs that indicate salmon are gone.

For example, on June 24, 1990, Mike caught 39 kings near Nigelius Point — fish were finning and jumping in all directions. This was Mike's best daily score, yet on the next day he caught none. We searched for miles, but the Inlet seemed totally devoid of king salmon. We did wonder if they had dived to the bottom, but this speculation found little support from scientists or fellow fishermen.

So, all of us were astounded when deep dives were recorded in 1992 for three of the four kings equipped with sonic tags. One of the fish repeatedly dived beyond 90 fathoms, but perhaps even more amazing was the speed of the dives — ascent and descent rates of 16 fathoms per minute were recorded. Some of the deep dives were of brief duration, others were extended for hours.

The following graph represents the depths recorded during one 21-hour continuous track of a tagged king salmon milling between Mountain Point and Brunn Point.



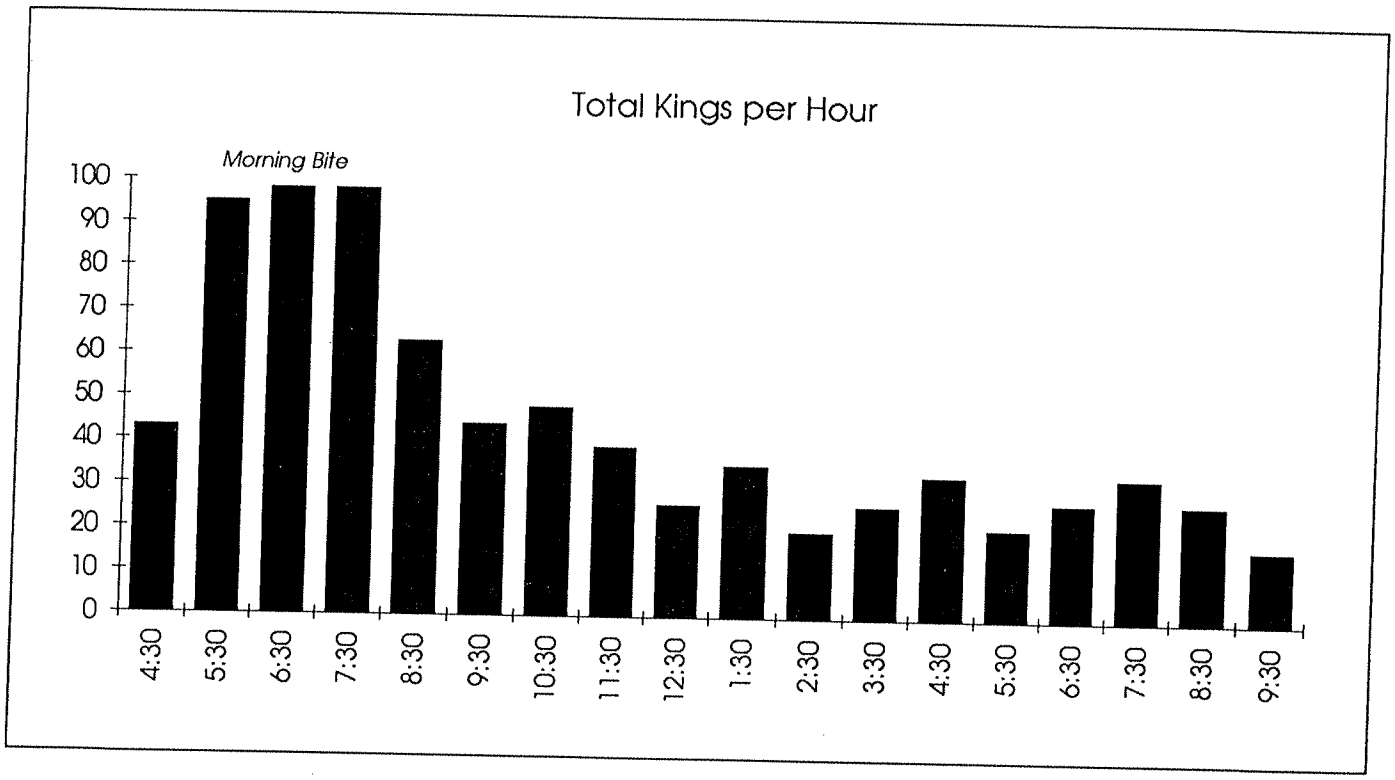
In another instance, early on the morning of June 25, we located three of the sonic- tagged kings near Nigelius Point at depths below 55 fathoms. It was not until almost noon that these fish rose to near the surface. That afternoon, one of the kings again dived deep, staying below 55 fathoms for almost two more hours.

This diving activity happened in almost the same location that the kings had seemingly disappeared exactly two years earlier. And, in another striking similarity, the previous day had produced Mike's best catch of the 1992 season (16 kings), but he caught only one on June 25.

These deep dives did not appear to be related to any hydrographic features within the Inlet. Nor did they appear to be related to foraging; horizontal activities during the dives (and during total darkness) were relatively minimal. On the other hand, the tagged fish were very active, horizontally, at dusk and

dawn. During our three seasons in the Inlet, we conducted a small amount of experimental trolling at night and at deep depths, up to 70 fathoms. We caught no kings in these efforts.

Our collected data does prove the general existence of a "morning bite" for the returning fish. More than 45 percent of the mature kings were landed by 7:30 AM, even though only 25 percent of the Lure Hours occurred in this period. (It is interesting to note that only 25 percent of the *immature* kings were caught by 7:30 AM.) The following graph represents the combined hourly distribution for both the mature and immature salmon.



We found no significant "evening bite" in Carroll Inlet. Even so, trollers who participate in other terminal fisheries should consider that tremendous evening bites were known to occur in the Neets Bay hatchery fishery before it was closed.

An evaluation of the collected data provides no evidence for the existence of a "tide change bite" in the Inlet. In the long run, according to the computer, a troller is about as likely to catch these king salmon during ebb, flood or slack currents.

Oddly, though the mature kings are caught at shallow depths, they tend to be found in deep water. The best fishing is in the entrance -- from Carroll Point to the "dogleg" -- and in the central Inlet -- from Island Point to Nigelius Point. The "drag" near Gunsight Point has been a particularly good "cookie jar" for both mature and immature king salmon. Few spawners are caught in the traditional trolling drags near Gnat Cove.

The returning salmon seem to undergo a staging period in the lower Inlet. Moving almost continually, the fish mill back and forth for days or even weeks. We were unable to locate any of the sonic-tagged kings for several days; we believe that during the milling process these fish backed out of the Inlet beyond Mountain Point or Bold Island.

Eventually, the milling salmon will move into the upper Inlet. This relocation comes sporadically in June; the timing and duration of the movement seems to vary from year to year. By late in the month, however, most of the mature kings have moved up past Island Point. Another staging process may occur in this area before the final push to the head of the Inlet. In all three seasons our best fishing has come late in June between Island Point and Nigelius Point. At this time, the morning bite is especially significant.

When the hatchery kings are "on the bite," then "clatter gear" -- short leaders fished close like coho gear -- definitely is best. In these "hot" bites, more lures mean more fish, and clatters that begin on the forward lines will spread to the nearby aft lines.

But, when these mature kings are "off the bite" then trolling fewer lures on longer leaders that are spread farther apart may be the most profitable technique. We advise trollers in the Inlet to be prepared to test both methods as conditions warrant.

As is true in all troll fisheries, good lures during one season may be poor the next. The "bright" #8 McMahon spoons that were so hot in the Inlet in 1991 were duds this season; in fact, no bright spoons worked well for us in 1992.

Mother-of-pearl spoons, though, continued to catch fish. We got good results from the #7 Canadian Wonder, the #7 Tom Mack, and the #7 Superior. I believe that the vivid mother-of-pearl finish on the Luhr-Jensen spoons fishes better in Carroll Inlet than do the more muted versions produced by some other companies.

Herring and hootchies worked well in 1992. Our best hootchie was the Yozuri E-89, followed by the Redden (or Luhr Jensen) C29CR, and the Golden Bait SMW24R. The cuttlefish C29CR has been a standard king hootchie in the Ketchikan area. This was the first time that we had tested the other two -- their success may not be repeatable in coming seasons.

The Yozuri E-89 is a "rainbow" hootchie that is virtually identical to the Redden J-206. Both are great ocean hootchies for kings and cohos. This year in the Inlet we compared a cuttlefish-sized E-89 with an octopus-sized J-206; the larger size was far superior. In our experience, cuttlefish hootchies worked better in this hatchery fishery than did the smaller versions of the same lure.

Jinkai crimpers and aluminum sleeves continued to perform flawlessly. These tools are great; I can't praise them enough. I was also very pleased with the new VMC stainless "Cone-Cut" hooks. They are strong, durable, easy to sharpen, and not brittle. In these days of increasingly slipshod hook production, the uniform quality of the VMC hooks seems exceptional.

And, I would like to give another pat on the back to troller Ira Merrill for his "Wrangell Rainbows" -- handmade hootchie inserts that are custom designed for a particular hootchie. Wrangell Rainbows are expensive, but they are worth it. These inserts don't transform a bad hootchie into a good one, but they will make a good hootchie great. Wrangell Rainbows have doubled the effectiveness of my best ocean hootchie -- the Golden Bait OC84R.

Back in 1989, a local old-timer assured me that the best lures for these hatchery kings were "herring and big, bright spoons." After three years of additional experimentation, Mike and I believe that the well-rigged Carroll Inlet troller should be prepared to fish the following gear:

1. *Herring, #7 mother-of-pearl Canadian Wonders, and large bright spoons.* Our computer statistical program agrees that the use of these lures is proven significant. When the fish were biting bright spoons (McMahons, Katchmacs, Superiors, Clendon Stewarts, etc.), all finishes appeared to work well, but bronze seemed best.
2. *An assortment of cuttlefish hootchies.* On some days these clearly are the preferred lures, but we did not have enough time for extensive research with this subject. The ones mentioned earlier in this report are good, but we are sure that others will work as well or better, at times.
3. *#950 Tomic plugs (6" or 7").* Trailing one or two of these brass-plated beauties from the aft lines will produce a slow but steady dividend. And, out in the ocean, they are sometimes very productive. All king salmon trollers should own a couple boxes of this lure. Sooner or later, the investment will pay off handsomely.

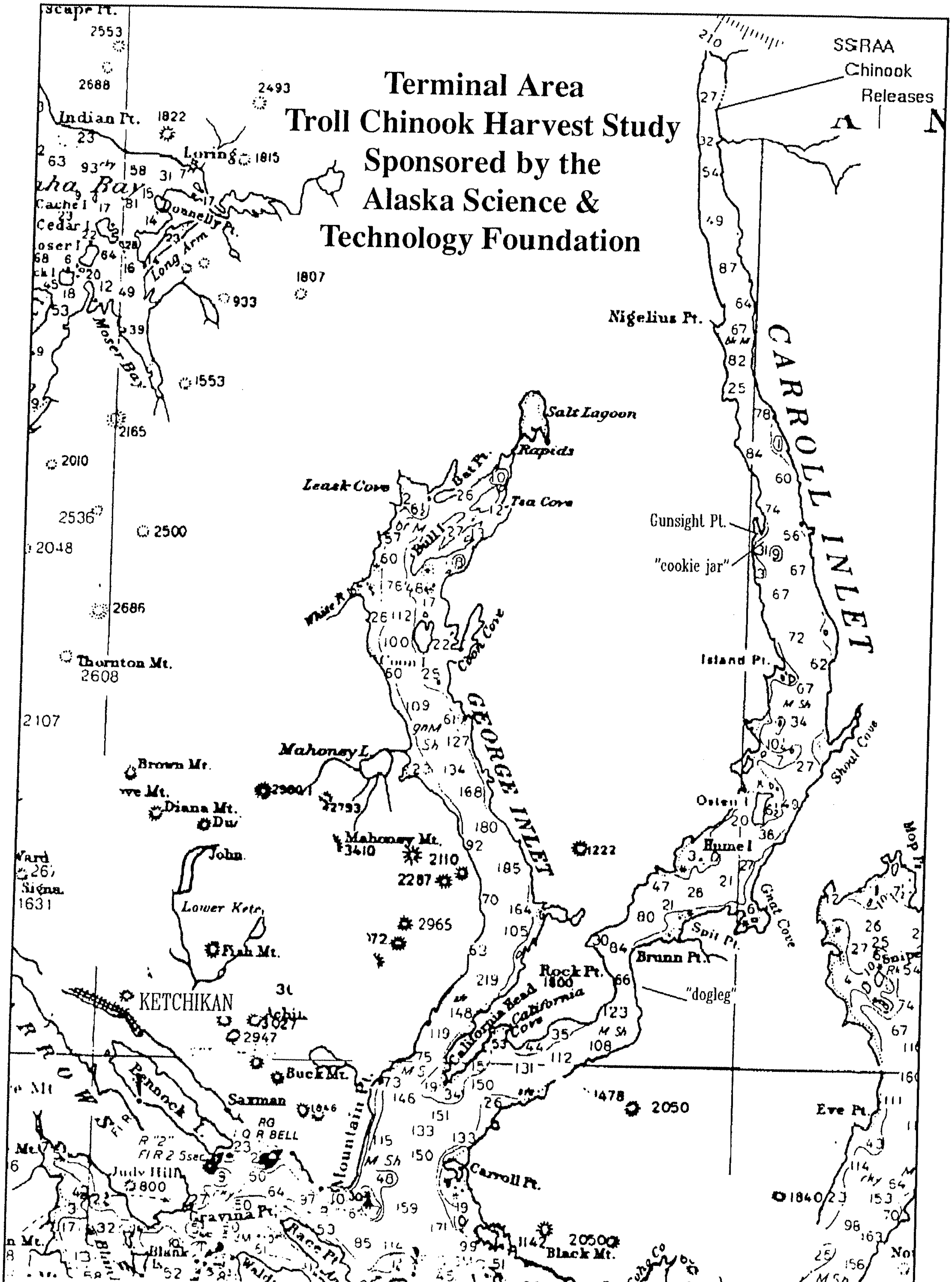
Potential profit, of course, is the bottom line for all fisheries. It is clear that the Carroll Inlet fish can be caught in significant numbers, even during poor years. Unfortunately, the financial return from these hatchery kings has fallen.

Ketchikan processors complain that these terminal area fish are not suitable for the frozen market due to diminished oil content. Prices were slashed drastically, down to 25 cents per pound in some cases. Alternative markets may be developed in the future. Meanwhile, under the current pricing structure, the Carroll Inlet troll fishery has become a marginal affair. Even so, Mike and I will be back next season; these kings provide an intriguing challenge and are a lot of fun when they are on the bite.

We greatly appreciate the gear, technical assistance and support that we received from the following individuals and organizations: Gibbs/Nortac Ltd., Jim Gilbert Enterprises, Herb Good, Hook Bros., Jinkai (U.S. Seven Oceans, Inc.), Ketchikan Gateway Borough, Luhr-Jensen, LumaLure, Ira Merrill, Terry Miller Associates, Nikka Industries, Pacific Net & Twine, Redden Net, Silver Horde, and Tomic Lures.

The truly fascinating biotelemetry study was accomplished with the cooperation of the Southern Southeast Regional Aquaculture Association, the Alaska Science & Technology Foundation, and the National Marine Fisheries Service. Additional funding for the sonic tags was provided by Murray Pacific Supply and Tongass Trading Company.

Questions? Write in care of PO Box 3006, Ketchikan, AK 99901.


Terminal Area
Troll Chinook Harvest Study
Sponsored by the
Alaska Science &
Technology Foundation
SSRAA
Chinook
Releases
CARROLL INLET
GEORGE INLET
Nigelius Pt.
Salt Lagoon
Rapids
Leask Cove
Tea Cove
Gunsight Pt.
"cookie jar"
Island Pt.
Shoal Cove
Mahoney L.
Mahoney Mt.
Hume I
Spit Pt.
Gnat Cove
Brunn Pt.
"dogleg"
Rock Pt.
California Head
California Cove
Mountain Pt.
Carroll Pt.
Black Mt.
Eve Pt.
KETCHIKAN
Saxman
Buck Mt.
Pennock I.
Gravina Pt.
Thornton Mt.
Brown Mt.
Diana Mt.
Indian Pt.
Loring
Donnelly Pt.
Long Arm
Moser Bay
Lower Ketc
Fish Mt.
Judy Hill

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Terminal Area Troll Chinook Harvest Study
Second Report to the Fleet - 1991

In 1990, the Alaska Science & Technology Foundation funded a research proposal that Michael Round (F/V *Cheri Marie*) and I (F/V *China Cove*) created to evaluate trolling gear and techniques used to harvest terminal area hatchery chinook salmon.

Our troll research is conducted within 20-mile long Carroll Inlet, near Ketchikan, where thousands of king salmon produced by the Southern Southeast Regional Aquaculture Association (SSRAA) return yearly during May, June and July. Within this "terminal area" the maturing hatchery spawners are much less inclined to strike traditional trolling gear.

For over a century trollers have fished gear that was designed to attract ocean-ranging feeding salmon. Within terminal areas, the spawning urges have become predominant. Even though only a few of these king salmon actually continue to feed, a significant portion of these king salmon may still strike a lure. We hope to define lures and techniques that will optimize the troll harvest of these reluctant kings.

The first stage of our research consisted of 12 days of trolling in June, 1990. A "Preliminary Report to the Fleet" describing the results of our work was published in the February, 1991, issue of the *Alaska Fisherman's Journal.*

The second stage of the project comprised 18 days of troll experimentation by both trollers in May and June, 1991. In addition, I fished China Cove for an extra four days to provide more data (and to take advantage of some good fishing). Our final experimentation will occur during at least 18 days of trolling in May and June, 1992.

For each day, one of us fishes a "standard" complement of troll gear, while the other is required to use "experimental" gear or techniques. The roles of "control" and "experimental" vessel rotate each day. Information regarding each lure put into the water is recorded into daily logs. The data from these logs is entered into a computer database later.

There are 23 data "fields" that may be logged into the "LURE" database for each lure. This information includes "Time In," "Time Out" and the catch of "Legal Kings," which are then used to establish the Lure Hours and the CPUE (catch-per-unit-of-effort). More than 21,500 Lure Hours have been recorded since 1990.

We have also established a "KING" database to log 14 information fields for each of the 669 legal kings that we have caught since 1990. We know, for example, that 41 percent (101) of the fish that we caught in 1990 were female, but 55 percent (232) of the 1991 fish were female.

Considering combinations of size and color, there are literally thousands of trolling lures. In today's shortened troll seasons there is not much opportunity for trollers to test gear and techniques. Too little time, too many variables — successful trolling is more art than science.

It is possible, though, to develop a degree of statistical certainty in some areas. Thus, we have two general goals — first, to learn how to catch more king salmon, and second, to extend a few of the limited boundaries of troll science.

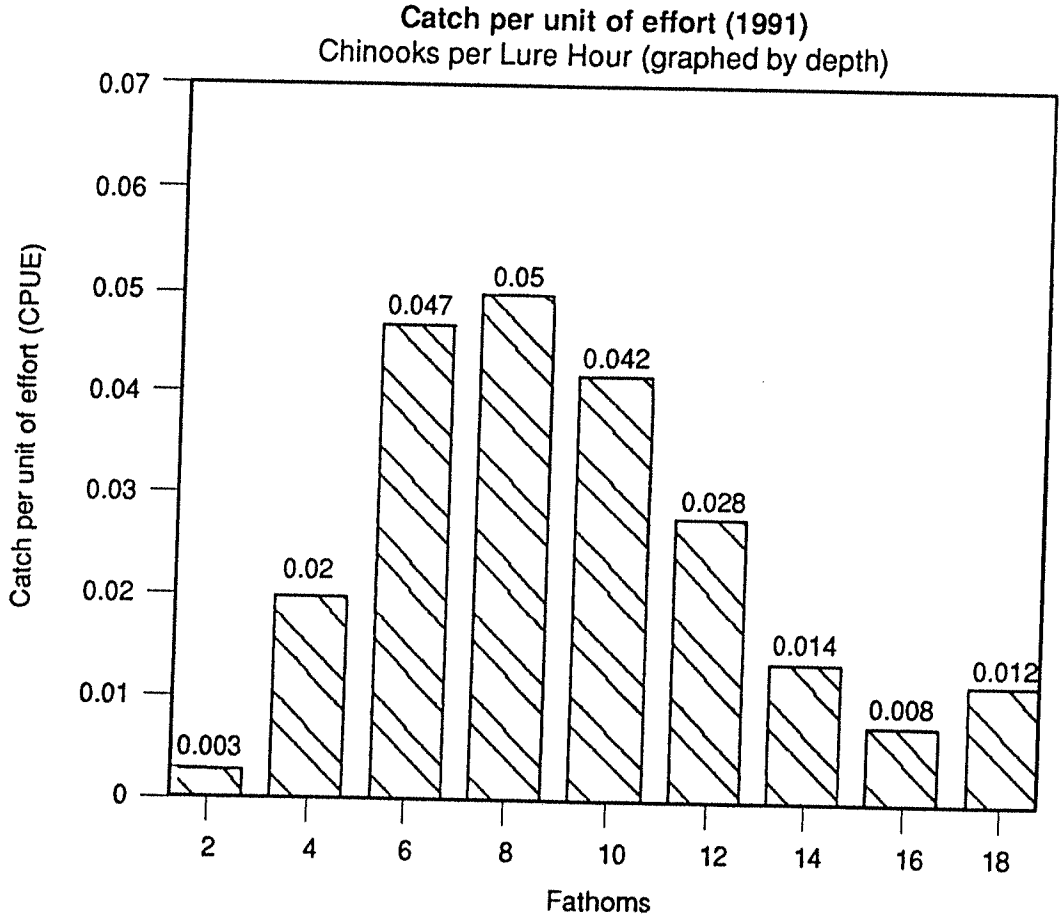
Mike and I used more than 125 lures in 1991. Some stayed in the water for only a few Lure Hours; others were tested for more than 800 Lure Hours. We caught 422 kings on 49 lures — 18 of these lures caught 10 or more kings each, while 20 lures caught two or fewer kings each. Only five percent (22) of the 422 kings were immature "feeders." The remaining 400 were mature spawners.

The lowest daily score for one boat was one king; the highest was 42 kings (40 caught by 8:30 AM, but only two more landed for the remainder of the day.) The scores varied dramatically from day to day and hour to hour: "Bites" can occur at any time of the day. Our best daily bite, both in 1990 and 1991, happened late in June on the "dark" kings milling in the central portion of the Inlet, above Island Point.

An evaluation of the collected data for both years demonstrates the general existence of a "morning bite." More than 43 percent (289) of the kings we have caught in Carroll Inlet since 1990 have been landed by 7:30 AM. The evidence for a "tide change bite" is less clear due to the complexities of defining the daily changes of tide throughout the long, narrow Inlet.

During much of our research we have fished 18 fathoms of gear. In both years, the returning spawners were harvested from shallower depths than most trollers would expect to find king salmon. With ocean-feeding kings, trollers often expect their bottom lures to produce the greatest number of fish, but we again caught more than 85 percent of these terminal area salmon at 12 fathoms or above.

In fact, if we factor out the 22 immature kings, which were caught mostly at 16 and 18 fathoms, then more than 92 percent of the spawners were taken at 12 fathoms or above. And, as in 1990, the "hottest" depth was only 8 fathoms. As the following graph demonstrates, trollers who target the zone from 6 to 10 fathoms are most likely to succeed.



In order to increase the number of lures that we were able to fish in this narrow "kill-zone," Mike and I trolled 2-fathom gear, two fathoms apart, in 1991. In 1990 we generally trolled 4-fathom gear, four fathoms apart.

The shorter 2-fathom leaders, bunched closer like coho gear, may have been detrimental during periods of "scratch" fishing but during bites this "clatter gear" works very well.

We see two reasons to recommend the clatter gear technique. One, more lures are placed in the kill-zone described above. Two, more "clatters" (several kings striking on the same line almost simultaneously) seem to occur.

We also suggest that all four trolling lines should be fished close together. For uniformity of gear presentation and cannonball sizes during the course of our research, Mike and I have chosen to fish float-lines. During 1990, I trailed my float-bags 10 fathoms back from the tag-lines, while Mike trailed his float-bags only 6 fathoms back. I caught only 27 percent of my kings on my trailing float-lines while Mike caught 40 percent on his floats.

In 1991, both of us trailed our floats at the 6-fathom distance. I caught 50 percent of my kings from my float-lines while Mike caught 48 percent from his floats. During bites, the clatters appeared to spread to the neighboring lines, thus increasing the overall effectiveness of the gear.

We believe that fishing clatter gear on trolling lines that are close to each other (using bow poles, "inside deeps," or float-bags) is a technique that should be considered seriously by Carroll Inlet terminal area trollers.

Even though these hatchery kings are caught at relatively shallow depths, they tend to be located in deep water. The best fishing in the Inlet is in the entrance (at or below the "dog-leg") and in the central portion (between Island Point and Nigelius Point). We have caught very few spawners in the traditional trolling "drags" near Gnat Cove.

Based on our very limited experience, we hypothesize that these returning salmon may "hold" at the entrance to Carroll Inlet for a period of days or even weeks, milling around in the deep water between Brunn Point and Mountain Point. Most of the salmon caught remain relatively "bright."

Then, periodically, segments of this milling horde will pass rapidly through the dog-leg into the inner Inlet, holding again in the deep water above Island Point. A majority of these fish are now "dusky," "dark" or "black."

In 1991, it was not until late-June that the thousands of darkening king salmon that had congregated above Island Point finally moved past Nigelius Point towards the net-pens at the head of the Inlet.

These terminal area kings often strike lures much more violently than do ocean feeders. So, to avoid broken leaders on the 2-fathom gear, I used 120-pound test Jinkai line, crimped with Jinkai aluminum sleeves. Since I prefer not to use snubbers, especially with short gear, I replaced the leaders every four days to ensure that they retained their full strength.

Mike and I have nothing but praise for the new Jinkai crimper and leader sleeves; they performed flawlessly and are practically fool-proof. We again predict that these aluminum sleeves will soon become the industry standard.

Our best lures in 1990 were large spoons and herring. In 1991, we continued to focus on spoon experimentation, including an eight-day test of our theory that the terminal area kings prefer spoons that are of an even larger size than most trollers are accustomed to use for ocean feeders.

We designed this test in response to several experienced trollers who, after our 1990 report, had commented that our most productive lure (#7 mother-of-pearl Canadian Wonder spoon) was "too big." These fishermen had never used this particular spoon, nor had they ever trolled for terminal area king salmon, but their preconceptions were overwhelming.

For this spoon-size test, we arbitrarily chose two sizes each of five spoon models: #6 & #7 m.o.p. Canadian Wonders, #6 & #8 brass Superiors, #7 & #8 brass/copper McMahons, #6 & #6-1/2 brass Katchmacs, and #7 & #8 gold-bronze Clendon Stewarts.

Both of us rotated, on a daily basis, two pairs of each model through the kill-zone. And, at the same time, the following pairs of spoons were rotated through the less productive depths: #6 & #7 brass Canadian Wonders, #7 & #8 brass Clendon Stewarts, and #6 & #6-1/2 gold Canadians.

The many variables inherent in trolling, including large daily fluctuations in our scores, made statistical certainty impossible to attain in only eight days, but the results are still interesting.

The #7 Canadian Wonders and the huge #8 McMahons greatly outperformed their smaller versions. The larger Katchmacs and Canadians also outfished their relatives. The sizes of the Clendon Stewart spoons did not seem to affect their satisfactory performance.

With the Superiors, though, the smaller #6 outfished the #8 during the size test, but for the entire 1991 research period, the CPUE for the #8 brass Superior was slightly superior to the CPUE for the #6. We have not had the time to do more than token experimentation with #7 Superiors, but we suspect

that at various times all three sizes of this spoon will work well in the Inlet.

Thus, there is no conclusive data supporting a general theory that the biggest spoon sizes are the best. But we advise Carroll Inlet fisherman to give due consideration to very large spoons.

In the last four days of research in 1991, during a good bite, we conducted a preliminary comparison of "bright" spoon finishes. Twelve #8 McMahon and #8 Superior spoons, in brass, bronze and brass/copper finishes, were rotated through the kill-zone. The six pairs of spoons were fished for only 220 Lure Hours each. The #8 bronze McMahon was the best spoon, catching 22 kings, followed by the #8 brass McMahon (19), the #8 brass Superior (17), the #8 brass/copper Superior (15), the #8 brass/copper McMahon (13) and the #8 bronze Superior (12).

We again recommend the #950 Tomic plug for use in Carroll Inlet. We fished one of these brass-plated plugs from a trailing leader on each float-line, above or below the kill-zone. This is not a "hot" lure for the terminal area kings, but it does consistently "scratch." The 6-inch and the 7-inch sizes of the #950 worked equally well.

Some trollers in the Inlet have had good days of fishing with hootchies, but we have not yet conducted extensive experimentation with these lures. Our best hootchie so far has been the cuttlefish-sized C29CR by Redden Net (or Luhr-Jensen), which seems much more effective on the few available immature feeders than it does on spawners.

In both years we have experimented with lightsticks in hootchies, in plugs, and attached to spoons. The only combination that has caught a few (six) kings has been a cuttlefish-sized C36CRLP hootchie with a green lightstick.

And, we have also tried various "scent" products that are supposed to make lures smell irresistible to salmon. None of the "scented" lures caught any king salmon.

We also tested a well-known product, used by mechanics throughout North America, which is designed to "penetrate," "displace water," and "loosen rust." Even though this liquid spray is marketed for use on machinery instead of fishing lures, its use is a very popular "secret" with salmon sportfishermen and commercial blackcod and halibut longliners throughout the Pacific Northwest.

On the day that we tested this liquid, the control vessel caught 17 kings while the experimental vessel caught only seven. This lower score does not disprove the fish-catching claims made for this product, but we opted not to continue additional research.

We had more luck testing #3 Willow Leafs, a type of "spinner blade" that is sold in many sportfishing catalogs. We drilled a larger hole into the end of these small pieces of brass or copper and then connected them onto lure hooks.

Our initial experiments indicated a significant improvement in catch rates when the shiny Willow Leafs were dangling from the hooks of large spoons. We therefore redesigned other portions of our research to allow further testing of Willow Leafs.

By the end of June the Willow Leaf comparison had expanded to 38 lures (35 spoons and 3 hootchies), 360 kings, and 11,747 Lure Hours. Some of the lures showed an improved CPUE, others did not. The differences were not major, and a comparison of total CPUE for all lures indicates only a 9.5 percent gain in catch rates when using Willow Leafs. This supposed improvement may not be statistically significant.

We conducted informal testing of the Willow Leafs during the regular summer chinook and coho fisheries with absolutely no success.

On the other hand, most of what are now my best chinook lures for ocean trolling have come from this project. Some of these lures also work well in Carroll Inlet, others do not. The following lures were very good to me in the summer of 1991: J-206 Redden Net hootchies, "JP" Tomic plugs, #7 m.o.p. Canadian Wonder spoons, #950 Tomic plugs, #8 Clendon Stewart spoons, and "Wrangell Rainbows."

The J-206 hootchies are so ugly that I still can't believe they caught so many kings and cohos. The "JP" plug is a must for every serious plug fisherman, as is the #950 plug. (And, by the way, I was very pleased with the new Super Star leader.)

Wrangell Rainbows are hand created "inserts" that are custom designed for a particular hootchie by fisherman Ira Merrill (PO Box 702, Wrangell, AK 99929). Ira's Wrangell Rainbow #84 is dynamite with the Golden Bait OC84R hootchie, and his #11 Glow works great with the Golden Bait

OG11. These inserts are more expensive than the mass-produced versions sold in gear stores, but trollers who use hootchie inserts should check out Wrangell Rainbows.

After combining the catch data from both years, we have produced our following "Top 12 Lures for Carroll Inlet," based on CPUE (total kings/total Lure Hours). Only lures which have caught at least 15 kings are listed. Note that these lures have caught only 62 percent of our terminal kings; the remainder were landed from 75 other lures.

LURE	HOURS	KINGS	CPUE
#8 bronze McMahon	221	22	.100
#7 bronze Katchmac	186	15	.081
#7 mother-of-pearl Canadian Wonder	910	58	.064
Herring (treble hooks & EZ baiters)	1,905	116	.061
#8 brass/copper Superior	253	15	.059
#8 bronze Superior	483	28	.058
#8 brass/copper McMahon	824	42	.051
#8 brass McMahon	393	19	.048
#C29CR hootchie	480	18	.038
#8 brass Superior	1,030	37	.036
#950 Tomic plugs (6" and 7")	782	26	.033
#6 brass Superior	637	19	.030

It must be recognized that this CPUE list is provided only for discussion purposes. Mike and I are good trollers, but we are not "highliners." There are many, many possible lures; we make no claim that these particular lures are truly the best for Carroll Inlet. We believe that the only CPUE results on this list that are statistically strong are those six lures with more than 600 Lure Hours of experimentation.

Note that the CPUE for our herring leaders represents the combined catch data for #612 EZ baiters and 4/0 treble hooks (used with #612 and #613 herring). Separately, the treble hook leaders have outfished the EZ baiters. And, it is interesting to note that on the days when the kings showed little interest in the herring leaders, the mother-of-pearl spoons also did not perform well.

There are no lures that have produced consistently; trollers in terminal areas, like most ocean trollers, must work through an assortment of lures to maximize their catch.

All in all, the terminal area fisheries in Southeast Alaska deserve more attention. Trollers who "stick and stay" eventually will "make it pay." Hand-trollers should note that Carroll Inlet provides an ideal small boat fishery: The kings are shallow and the seas are calm. As one hand-troller put it, "If all trolling was like this, I would never buy a power-troll permit."

Yes, many of these terminal area kings are dark, ugly, white-fleshed and low-valued, but I caught 6,000 pounds (worth $10,000) in 22 days of trolling in Carroll Inlet in 1991, and still had enough free time to participate in the other local "hatchery access" openings. It may not be fantastic fishing, but it beats staying tied to the dock.

Mike and I offer our very sincere thanks to the following gear manufacturers and suppliers from both sides of the U.S./Canada border for their donations of gear and technical assistance: Gibbs/Nortac, Jim Gilbert Enterprises, Hook Bros., Jinkai, LumaLure, Ira Merrill, Murray Pacific, Nikka, Pacific Net & Twine, Redden Net, Silver Horde, and Tomic Lures.

For additional information regarding our project, write to Mike or me at PO Box 3006, Ketchikan, AK 99901.

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24 HOURS IN THE LIFE OF A MATURE KING SALMON

by Lonnie Haughton

In June, 1992, Ketchikan trollers Lonnie Haughton (F/V China Cove) and Michael Round (F/V Cheri Marie) completed the final phase of a project to evaluate experimental trolling lures and techniques targeting hatchery king salmon returning to the Carroll Inlet "remote release site" operated by the Southern Southeast Regional Aquaculture Association (SSRAA). Their study was funded by a grant from the Alaska Science & Technology Foundation (ASTF).

Much of their 1992 research involved "biotelemetry" -- four kings were tagged with ultrasonic transmitters and then tracked for extended periods. This pilot study was coordinated with researchers Joseph Orsi and Adrian Celewycz from the Auke Bay Laboratory of the National Marine Fisheries Service (NMFS).

The essential tools for this research are pressure-sensitive "sonic tags." These devices emit low-frequency signals which may be detected by a submerged hydrophone connected to an onboard receiver. Each tag is approximately four inches long, 3/4 inches in diameter, and weighs 1/2 ounce. Four of these tags, which cost $500 each, were used. Funding for the tags was provided by ASTF, SSRAA and two local fishing gear suppliers, Tongass Trading Company and Murray Pacific Supply.

Once activated, each tag's battery had a life expectancy of 7 to 14 days depending on its depth of operation. At the surface the tags emitted a pulse every half-second; at 75 fathoms the tags emitted a pulse every second. When tuned to each tag's individual frequency, the receiver precisely computed, in milliseconds, the interval between sonic pulses. This "pulse interval" could then be translated into the depth of the tagged fish. The hydrophones were able to detect the underwater signals to a distance of one half mile.

On June 13, in lower Carroll Inlet, four large mature king salmon were fitted with the ultrasonic transmitters and then released. Each tag was attached on the back of the fish near the dorsal fin. Over the next 14 days the tracking team was able sporadically to locate all four salmon, although there were long periods in which none of the fish could be found. By June 26, two of the tagged kings had been captured by a purse seine vessel conducting "cost recovery" work for SSRAA. The remaining two tags were never recovered.

The project coordinators will distribute a full report of their research in 1993, but the team members have released the following preliminary details of a 24-hour continuous track of one tagged king.

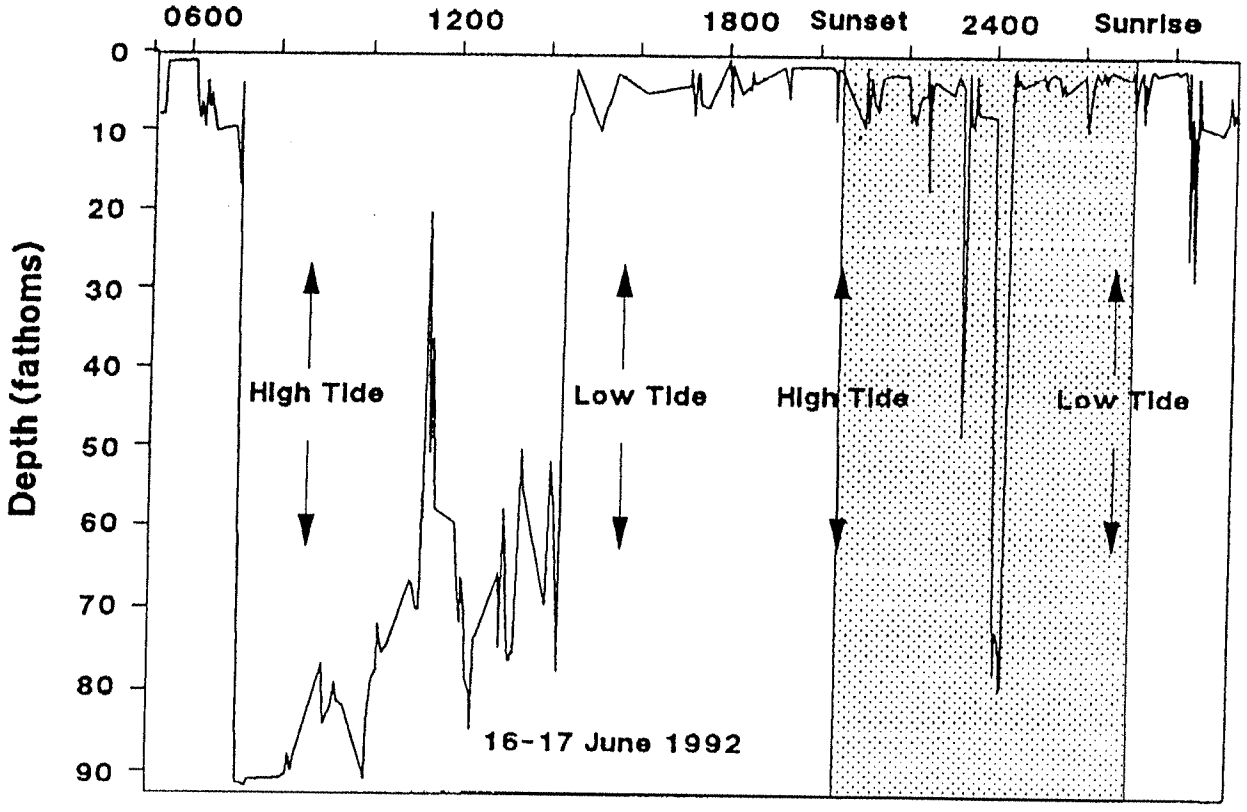
24-HOUR TRACKING -- VERTICAL DISTRIBUTION

Continuous tracking of King Salmon "A" began at 0530, June 16. At this time the depth of the fish was less than 10 fathoms. At 0715, "A" dived rapidly to 90 fathoms. During the next seven hours, "A" generally remained below 55 fathoms; bottom depth during this period ranged from 90 to 150 fathoms. At 1430, "A" ascended rapidly and then remained above 10 fathoms for the next eight hours. Dives as deep as 80 fathoms occurred near midnight.

During the course of the project the four tagged king salmon resided primarily in the top 10 fathoms of the water column, but deep dives were recorded for three of the fish. This deep diving behavior was a scientific surprise and did not appear to be related to any hydrographic features within the Inlet. The kings were diving far below the thermocline and halocline zones -- depths at which temperature and salinity gradients are at their maximum.

Descent rates for the deep dives averaged 8 fathoms per minute and ascent rates averaged 12 fathoms per minute. Maximum descent rates exceeding 16 fathoms per minute were recorded. The dives did not appear to be associated with active foraging, although the fish may be repeating behavior patterns characteristic of their oceanic existence. It is well documented that king salmon are the most numerous salmon species incidentally caught in the bottom trawl fishery even though they are the least abundant salmon in Alaska.

Vertical Distribution of King Salmon "A" in the Entrance of Carroll Inlet



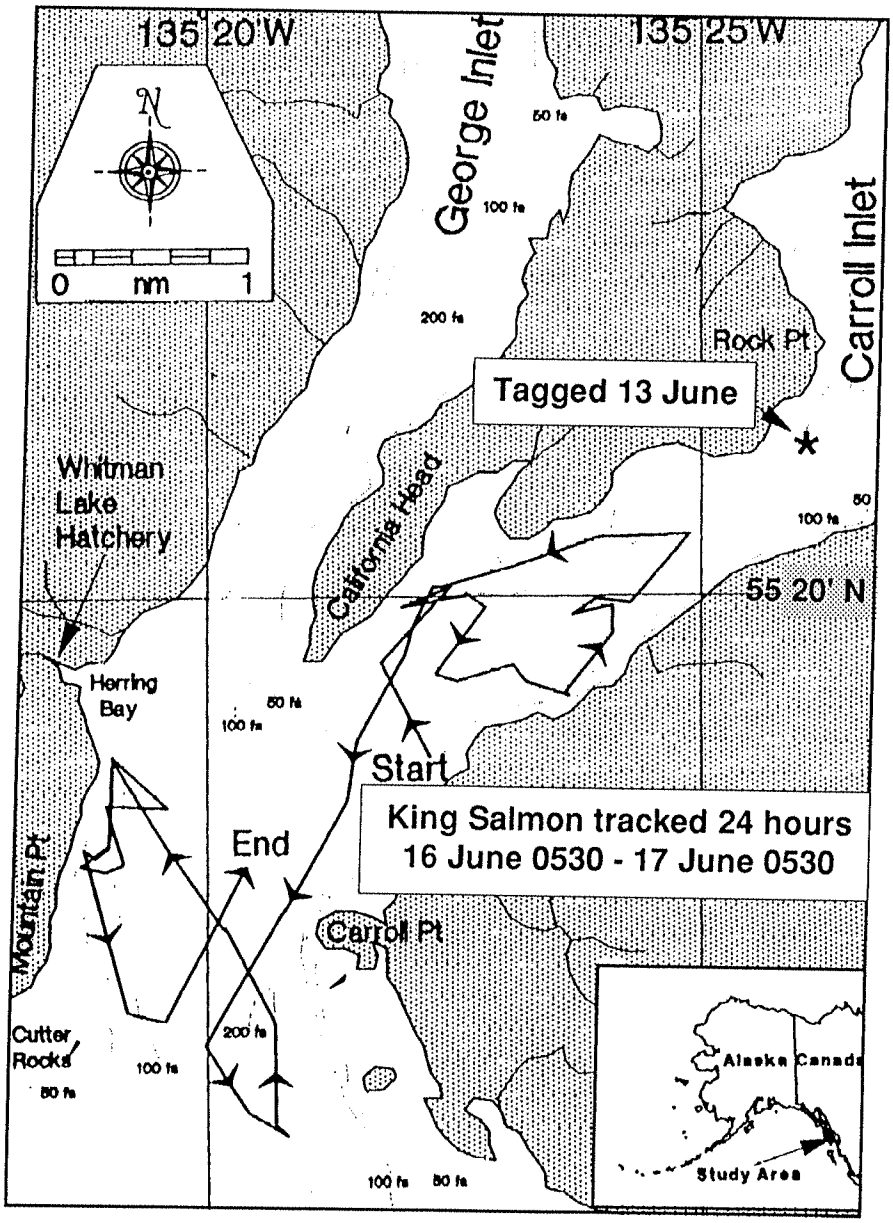
24-HOUR TRACKING -- HORIZONTAL DISTRIBUTION

Horizontally, King Salmon "A" moved almost constantly, while frequently changing direction. This charted position of "A" (following), which was updated every one-half hour, is only an approximate rendition of the salmon's zig-zag milling behavior. During the 24-hour period, "A" traveled 17 nautical miles and yet ended up only one nautical mile from

the start. Note that this track occurred approximately 20 miles from the head of Carroll Inlet, which was the eventual destination of the fish.

While it varied considerably, average speed for "A" in the 24-hour track was 0.71 knots. (On June 26, a tagged king was observed to sustain a steady 2.5 knot speed for one hour.) Horizontal movement was relatively minimal during the deep dives or during the few hours of total nightfall. "A" moved a relatively small distance during the complete darkness between 2245 and 0215 (June 17), although a deep dive occurred during this period. On the other hand "A" was horizontally active at dusk and dawn.

This intriguing vertical and horizontal information does not necessarily represent standard behavior for mature king salmon. More information from the project is forthcoming, but further research is needed to address and confirm the preliminary findings of this pilot study. Still, the results are an exciting addition to the limited knowledge of scientists and fishermen alike.



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Terminal Area Troll Chinook Harvest Study

1990 Preliminary Report to the Fleet

The trolling was terrible at the net pens at the head of Carroll Inlet. After six hours of trolling, I had landed only a few kings. Ugly, black, snaggle-toothed hatchery kings. My partner Mike was doing no better. What explanation could I offer for our poor catches: Lack of fish or lack of skill?

My ego preferred the first excuse. But that option was dashed with the arrival of the seiner *Sabrina*, conducting cost recovery work for the Southern Southeast Regional Aquaculture Association. The seiner's crew brailed aboard 30,000 pounds of kings from their first set.

It was immediately obvious that our troll research targeting mature hatchery chinooks needed refinement.

As previously reported in the Alaska Fisherman's Journal, Mike Round (*Cheri Marie*) and I (*China Cove*) have secured funding from the Alaska Science and Technology Foundation to seek improved troll gear and techniques for the harvest of terminal area hatchery chinooks.

We conducted 12 days of experimental trolling last June, and will follow up this initial phase of the research with 36 additional days of fishing during June of 1991 and 1992.

Our place of research is 20-mile-long Carroll Inlet, near Ketchikan, where thousand of SSRAA kings return yearly during June and July. Within this "terminal area," these maturing hatchery salmon become less inclined to strike the standard trolling gear. Sex becomes more important than food. We hope to find lures that will entire more of these reluctant kings to strike.

We have received strong support, including gear and technical advice, from the leading manufacturers and suppliers from both sides of the U.S.-Canada border, including Silver Horde, Luhr-Jensen, Tomic Lures, Nikka and Jinkai.

To compare the effectiveness of the lures and techniques during each day of trolling, one of us fished a standard complement of troll gear, while the other is required to fish only experimental gear. The roles of "control" and "experimental" vessel rotate each day. For each lure that we fish, and each salmon we land, we log all pertinent information onto daily data sheets.

This data is later punched into a computer data base which allows us, among other things, to demonstrate the catch per unit of effort (CPUE) of each lure.

I cannot say that the average troller on the dock has much faith in our research. As one old time Ketchikan highliner put it, "Everyone knows that the best gear for those kings is herring and big, bright spoons."

I am always amazed by such confident pronouncements. How long does one have to practice the art of trolling before he reaches such a state of certainty? After 18 years at the game, I do not have much confidence that any of my gear is the "best." When will I ever achieve such a yoga-like state of trolling serenity?

Probably never. The more I learn, the less I seem to know. I have enough "hot" fishing gear stored on the *China Cove* to outfit a fleet of trollers, and yet some hotshot is always outfishing me with a lure or technique I have never tried.

When one considers combinations of size and color, there are literally thousands of trolling lures. No single fisherman will ever have the time to test them all. Over time, though, a fleet of trollers will experiment with many of the most likely lures. The results will trickle down, sooner or later, to interested fishermen.

One goal of our project in Carroll Inlet is to speed the experimentation on these "most likely" lures. Today's shortened trolling seasons allow fishermen little time to test alternative gear. We are doing some of their research for them.

We are also testing many "less likely" lures, the ones that may cause trollers to burst into laughter. These lures may be "funny-looking" to a commercial fisherman, but they are often used by sport fishermen with great success. Can these sportfishing lures and techniques be adapted to commercial trolling for these terminal area hatchery chinooks?

At this stage of the project, we have no definite answers. Considering such variables as model, size and color, we trolled a total of 174 different lures at various times during the 12 days of fishing in 1990. We also tested experimental techniques, such as modification of line voltage.

We caught 247 adult kings during the period, from 53 lures, both experimental and standard. During our best day of fishing, the standard boat landed 39 kings while the experimental gear caught 14. To illustrate the unpredictability of trolling, note that on the next day the standard gear caught only five, while the experimental boat caught none.

Our best day and our worst days of trolling happened near the head of Carroll Inlet. The steadiest fishing, though, was at the entrance, which also produced the brightest, most valuable kings. The guys at the local cold storage were not enthused about marketing some of the black "alligators" we caught near the net pens, but since then they have produced some excellent smoked salmon jerky from these darker kings.

As predicted by the old timer, herring and "bright" (bronze, brass, brass/copper, and brass/chrome) spoons (Katchmac, Superior, Kachmor, McMahon, and Diamond King) worked well. In general, bronze seemed to best the best "bright" finish. (At the end of this report, I have listed our most successful lures.)

One of our most successful spoons was one that neither of us had ever fished before, the #7 mother-of-pearl Canadian Wonder distributed by Luhr-Jensen. To the chagrin of the few local trollers who know how well this particular spoon fishes, we now are sharing their secret with the entire fleet.

We had negligible success with plugs, but a limited test of a seven-inch version of the new #950 plug by Tomic Lures proved promising. I used the #950 again during the regular July chinook fishery and was extremely pleased with the results. This brass-plated plug seems to catch chinooks when the fish are also striking large bright spoons.

The #7 mother-of-pearl Canadian Wonder also fished very well during the summer season. I recommend the addition of the #950 plug and the Canadian Wonder spoon to every troller's gear collection.

Although some hootchies normally are excellent lures in the Ketchikan area, we were unable to achieve consistent success with any hootchie in Carroll Inlet. The six which worked the best were the cuttlefish C36CRLP and C29CR by Redden Net, the experimental P-15 and MB-2 by Michael Bait, and the OG142R and OG140R by Golden Bait.

Both Mike and I were extremely pleased with the new Jinkai crimper and soft, aluminum sleeves donated to our project by U.S. Seven Oceans, Inc. The Jinkai sleeve is similar to a competitor's model that is already popular among the Canadian fleet. I predict that this type of aluminum sleeve will become the industry standard.

We did not conduct controlled comparisons among competing brands, but we were also very satisfied with the Jinkai leader donated by U.S. Seven Oceans.

While none of the less likely lures caught kings as well as the more standard gear, we did have some luck with Kwikfish, Tee-Spoons, Rapalas and Hotshots. The best of the sportfishing lures was the large #6 brass Tee-Spoon spinner.

Both the red and the rainbow Tee-Spoon spinners that we tried were less successful than the brass, indicating again that these salmon seem to prefer bright finishes.

The banana-shaped Kwikfish plug, which according to expert Herb Good has "revolutionized" charter sportfishing on the Kenai River, provided interesting results on the dark spawners at the head of Carroll Inlet, but fished extremely poorly on the brighter kings at the entrance to the Inlet.

The Kwikfish must be trolled very slowly. We will continued our experimentation with the Kwikfish and the other promising types of sportfishing gear next June.

We experimented, inconclusively, with slow trolling, at speeds approximately half the range for normal trolling. To enable me to reduce *China Cove*'s trolling speed, we worked with Ketchikan sailmaker Louis Bartos to produce small custom-made drogues.

These funnel-shaped devices, which were towed directly beneath the surface under the turn of the bilge on each side of the boat, were effective, efficient and economical. The drogues could be engaged or removed from the water literally in seconds. Any troller looking for a low-cost means to slow boat speed should contact Louis at Mariner Sails in Ketchikan.

We experimented, also inconclusively, with the underwater electrical fields produced by the galvanic action of the dissimilar metals of the boats and the fishing gear. Using a "black box," we boosted the line voltage to a full volt.

For my boat, the boosted DC voltage seemed, during the morning, to help the catch rate and then, for the remainder of the day, to totally kill the fishing. Such perceived effects may have been coincidental.

The modified voltage seemed to have no effect on Mike's fishing. Drawbacks of the increased current included corrosion of the stainless trolling wires and of the ball-bearing swivels ont he line snaps. We plan further study in this area.

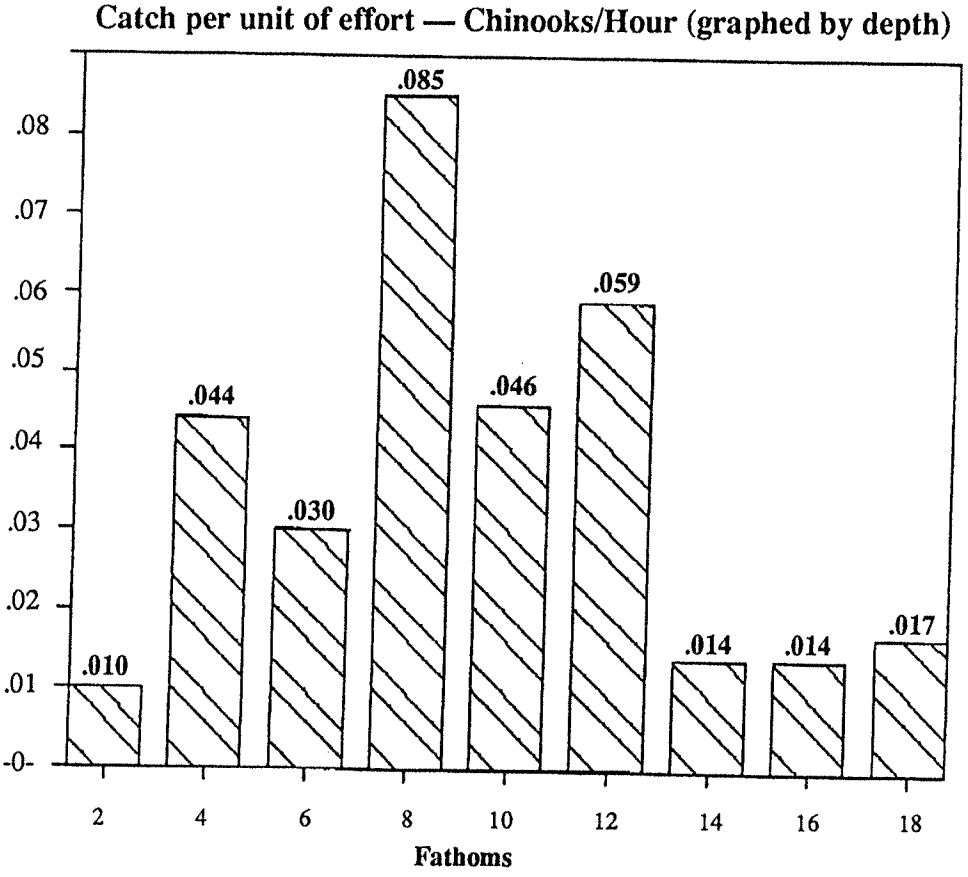
We also conducted night trolling, using lightsticks and other assorted "glow" fishing gear. We caught kings at dusk and the crack of dawn, but none at night.

While we did experience time periods of good fishing, when the salmon were clearly "on the bite," examination of the computer records showed — contrary to all expectations — no strong correlation between slack tide and these "bites."

Our catch data did provide dramatic evidence to support the claim by most local trollers that these hatchery kings are caught closer to the surface than is usual for chinook trolling.

During most of the project, we fished five to seven lures on each of the two-fathom marked lines, with the bottom lure at 18 fathoms. In the standard chinook fisheries, summer or winter, most trollers expect the bottom lures to produce the greatest number of fish. But in Carroll Inlet, more than 85 percent of our salmon were caught at 12 fathoms or above.

As the following graph strikingly shows, lures which are fished at eight fathoms are five times as likely to catch a king than lures at 18 fathoms.



In fact, approximately two thirds of the salmon were caught between eight and 12 fathoms down. Another 20 per cent were caught above eight fathoms. Even after averaging the total lure/hours for the three depth ranges, the computer shows that we were 4.5 times as likely to catch a king in the middle of the gear than on the bottom lures (below 12 fathoms). And, considering the catch per unit of effort, we were more than twice as likely to catch a fish on the top spreads as on the bottom.

After reviewing the data, it is obvious that depth is a highly important factor in judging the success of the various lures. To provide a fairer perspective of lure catch per unit of effort, we "weighted" the total hours a particular lure was fished to adjust for the less successful catch rates at the top and bottom of the gear.

By using the catch per unit of effort, and the weighted catch per unit of effort, we were able to produce the following lists of our ten "best" lures. Note that I have listed only lures fished for at least 50 hours. The number of kings caught by a lure is divided by the hours the lure was fished, and also the weighted hours the lure was fished, to produce the catch per unit of effort and the weighted catch per unit of effort.

(It is important to recognize that Mike and I are trollers of average fishing ability who fished only a small amount of the myriad number of possible lures. There was at least one troller in Carroll Inlet who claimed a catch rate that doubled ours. Our catches per unit of effort for these particular lures are listed solely for the interest of fellow fishermen, with no claim by us that they are truly the best lures for fishing Carroll Inlet.)

LURE	Hours	Kings	CPUE	Weighted CPUE
#7 Bronze Katchmac	52	8	.154	.307
Herring (4/0 Treble hook)	151	22	.146	.162
#8 bronze Superior	106	12	.113	.182
#7 mother-of-pearl Canadian Wonder	423	45	.106	.134
Herring (612 EZ baiter)	265	24	.090	.102
#5 brass Katchmac	52	4	.077	.348
#7 gold/bronze Katchmac	81	6	.074	.118
#C36CRLP hootchie	63	4	.063	.100
#6 brass/copper McMahon	176	10	.057	.157
#6 brass Tee-Spoon	126	7	.056	.070

Note that the gear from our Top Ten list caught only 60 per cent of the salmon; the remaining kings were landed from 43 other lures. It also should be noted that the catches per unit of effort for several Diamond King spoons, the #950 Tomic plug and one Kwikfish were also good, but these lures were not listed because none were fished for more than 50 hours.

Again, it should be recognized that these scores are provided for discussion purposes only. It would be ridiculous, for example, to think that our data prove that a lure which only caught four fish during the 12 days was one of the best of all possible lures. It is only the four lures, two spoons and both herring-rigs – which have more than 100 hours of experimentation, doubt-digit catches and great catches per unit of effort – that I would recommend unreservedly.

As part of our project, two scientists with extensive statistical background are reviewing the data bases as we prepare for next June. Mike and I will leave the scientific proofs to them.

We will continue our experimentation with these and other interesting lures and techniques next June. For further information, or if you wish to offer advice or criticism, please contact us.