

CHINOOK COHO CHUM PINK CHINOOK COHO CHUM PINK CHINOOK COHO CHUM
HATCHERY NEWS
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Armstrong-Keta, Inc.

Spring 2015

Port Armstrong Hatchery Production

The Port Armstrong Hatchery has gradually been expanding over the 32 years since its first egg take in 1983, when it was permitted for 11 million combined pink and fall chum green eggs. After an auspicious start, the hatchery was just reaching a sustainable size when the new onslaught of farmed salmon collapsed wild Alaska salmon prices in the early 1990's. Our original business plan turned out not to be viable, and AKI embarked on a series of expansions in its production levels to achieve greater economies of scale. The original concept of the independent "mom and pop" hatcheries, small enough for a family-run backyard enterprise, died on the vine. Some of the original mom and pops closed down; others scrambled to adjust to the new economic realities and grew into financial stability. AKI is still on that path, having started six years after DIPAC, and with recent expansions we're about to cross over the threshold of long-term viability.

In addition to our permit of a combined 5 million coho and king, our hatchery's pink and chum production was recently increased from 85 million pinks and 30 million chums to its current permitted level of 105 million pinks and 60 million chums. In 2014 we incubated approximately 88.7 million pink eggs, 24.4 million chum eggs, 2.37 million coho eggs and 285,000 king eggs. This winter was characterized by record-breaking mild weather, and our water temperatures stayed warm almost all year. All our fish were significantly larger than normal by release time, which bodes well for their marine survivals. We ended up having to purchase quite a bit of extra fish feed, but we are confident that the elevated returns will more than make up for the extra expense and effort.



Overview of Port Armstrong from a nearby mountain.

Photo by Bart Watson

During late April and early May this year, the hatchery released approximately 87.7 million pink salmon along with 22.8 million summer chum salmon. In addition, AKI just released 1.95 million coho smolts, 56,000 regular king

smolts and 97,000 zero check king smolts. (Zero checks are simply smolts accelerated with warm water and released in their first spring after hatching rather than rearing for an entire year in fresh water. See the article on “Innovation” below for more information.)

As AKI reaches full production and continues to make progress paying down its loans to the state Fisheries Enhancement Revolving Loan Fund (we’ve now made full scheduled annual payments for the past five years in addition to supplemental loan payments), we will expand our ability to contribute to the common property. AKI sees a prosperous path ahead, similar to the route DIPAC was able to follow in paying off its large debt burden. Instead of making large loan payments, DIPAC is able to make major financial contributions to the regional aquaculture associations and also open up some of its cost recovery areas to common property terminal harvests.

Port Armstrong Hatchery				
Historical releases by species				
Release Year	Pink	Coho	Chum	King
1984	7,400,000			
1985	7,500,000		1,851,000	
1986	9,676,000		1,626,000	
1987	12,350,000		1,982,000	145,000
1988	19,370,000		1,287,000	
1989	16,040,000		43,000	90,000
1990	22,420,000	122,000	142,000	144,000
1991	50,116,000	207,000	795,000	62,000
1992	39,616,000	165,000	423,000	396,000
1993	51,189,000	82,000	Discontinued fall chums	1,275,000
1994	43,000,000	828,000		Suspended to switch stocks
1995	53,839,000	642,000		
1996	72,480,000	1,385,000		
1997	81,012,000	952,000		
1998	75,777,000	124,000		
1999	73,269,000	625,000		
2000	85,639,000	1,358,000		
2001	52,344,000	976,000		
2002	72,664,000	1,469,000		
2003	83,471,000	1,331,000	Summer chum program	107,000
2004	83,835,000	1,341,000	13,406,000	96,000
2005	80,111,000	1,581,000	575,000	83,000
2006	78,172,000	2,616,000	3,881,000	274,000
2007	78,211,000	2,157,000	17,448,000	812,306
2008	60,000,000	2,510,000	13,785,000	755,000
2009	21,439,000	3,148,000	12,417,000	553,000
2010	53,677,000	3,224,000	27,296,000	276,000
2011	75,506,000	2,275,000	28,445,000	250,000
2012	82,734,000	2,380,000	26,459,000	249,000
2013	52,120,000	2,243,000	25,695,000	457,000
2014	79,659,000	2,467,000	25,029,000	161,000
2015	87,665,000	1,950,000	22,817,000	153,000
TOTAL	1,762,301,000	38,158,000	225,402,000	6,338,000

The Season Ahead: 2015 Forecast

Like so many other things, forecasting salmon returns is a blend of art and science. This year will be particularly interesting, with such an unusually warm winter and spring. Most biological events in our area have been advanced by a month or more this year.

Pink salmon: Port Armstrong pink salmon returns tend to follow the strength of the wild runs. NOAA and ADF&G are forecasting an excellent harvest of 58 million fish (which would fall within the top ten pink harvests since statehood), so it seems likely that returns to Port Armstrong will also be relatively strong. If so, it would continue the recent trend towards strong odd-year pink returns. With that in mind, our forecast is for a total return of just over **3.1 million pink salmon** this year. One thing we'll be watching is the different survival rates between our two release groups, one of which was accelerated with warm water during incubation and released at a larger size (0.64 grams vs. 0.40 grams).

Chum salmon: Since each brood year returns over a period of several years, chum salmon give forecasters the luxury of some foreshadowing. One year's 3-year old return provides some hints about how many four and five year olds will come back in later years. Based on this method, our forecast would be a total return of about 150,000 chum salmon, due mostly to the relatively small number of 3-year olds seen in 2014. However, age composition can vary widely from year to year, so we've factored in standard assumptions of marine survivals and age composition to forecast a more optimistic **219,000 chums**.



Harvest time at Port Armstrong. Photographer unknown

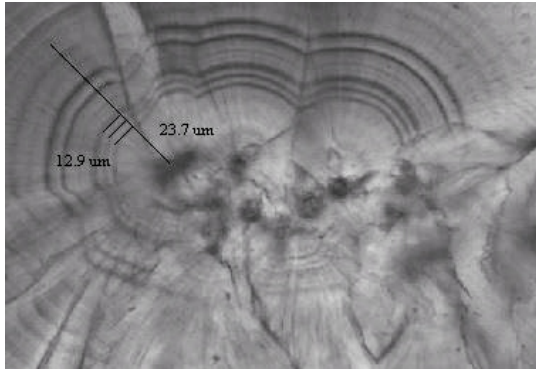
Coho salmon: Based on weak average return rates of the past decade, the coho return forecast would be just shy of 114,000 fish. However, the smolts making up this year's return were larger than most when released, and we saw a huge number of jacks returning in 2014, so we're anticipating that their marine survival will be better than average, and our forecast is **247,000 cohos**.

King salmon: Due to their complex age structure, king returns are the most complicated to forecast. Just to add to that complexity, Port Armstrong has released both conventional and zero-check smolts (released after just one year of rearing, rather than two, as discussed in the previous article). Luckily, all that complexity tends to smooth out the effects of year-to-year variation. Based on average return rates, this year's forecast is for a return of about 4,100 kings of all ages. However, weak king runs statewide in recent years, combined with few recovered tags in the troll fishery this winter, has reduced our forecast to **3,000 kings**. We'll be closely following our zero-check releases, which have outperformed the conventional smolts in some years.

Forecast of 2015 Port Armstrong Hatchery returns				
Species	Total Return	Common Property Harvest	Return to Hatchery	Broodstock Needed
Pink	3,100,000	1,364,000	1,736,000	160,000
Chum	219,000	43,800	175,200	80,000
Coho	247,000	123,500	123,500	3,000
King	3,000	1,000	2,000	600

Contributing to Southeast Alaska Fisheries

The primary mission of the Port Armstrong Hatchery is to produce salmon for common property fisheries. Fulfilling that mission is challenging enough, but measuring that contribution is a challenge on its own. For king and coho salmon, the coded-wire-tag (CWT) program provides a wealth of information for hatchery and fisheries managers. Most fishermen are probably familiar with this program, which has been in place along the entire West Coast for decades. Information about releases and recoveries of tagged fish is easily available from the ADF&G online database.



Microscopic view of thermal marks on Port Armstrong pink salmon otolith. Photo ADF&G

Pink and chum salmon are a bit trickier. While it has been done, using CWTs isn't really practical due to the small size of pink and chum fry and the sheer numbers of fish to be tagged. Instead, the hatchery can mark the otoliths of fry during incubation to create an otolith mark. Salmon otoliths are small bone-like structures near the brain that lay down rings in response to temperature changes and growth rates, much like tree rings. By varying the water temperature, we can create a recognizable "code" in Port Armstrong salmon otoliths that can be read under a microscope. This technique is now used to mark the majority of hatchery pink and chum salmon in Southeast.

However, marking fish is only half the battle. In order to estimate how many hatchery salmon are caught in common property fisheries, hatchery operators must collect representative samples from those fisheries and check their otoliths for marks. In 2013 and 2014, AKI conducted a pilot program to sample seine fisheries that were thought to harvest Port Armstrong pink salmon. We focused on Districts 109 (lower Chatham Strait), the area closest to the hatchery, and 104 (outer coast of Prince of Wales), as Port Armstrong pinks had been found there in 2012. In 2014, however, wild pink runs in the region were weak enough that seine openers were severely limited, and only cursory results were available for the few pink common property fisheries held in our area.

With our 2013 sampling, we found Port Armstrong pink salmon contributed to seine catches in both areas. Based on our data, almost a million Port Armstrong pinks were caught in 109 and 104, along with another 150,000 in other nearby districts.

Estimated seine catch of 2013 Port Armstrong pink salmon		
District	Number of fish	Value
104	340,000	\$389,000
109	625,000	\$715,000
Other	150,000	\$172,000
Total	1,115,000	\$1,276,000

Figures for coho and king catches are much easier to come by. Throughout the season, we watch the ADF&G tag lab database for recoveries of Port Armstrong cohos and kings, which provides a great "real time" view of the strength of the run. Most of those fish are caught by trollers in the lower Chatham Strait and Sitka areas, but some are picked up as far away as Yakutat. According to estimates from tag data, over 94,000 Port Armstrong coho were caught in both 2013 and 2014, with the vast majority ending up in troller holds. Trollers also caught the bulk of our kings – especially in the Tebenkof Bay area spring fishery.

2013 and 2014 troll catch of Port Armstrong kings and cohos (including mean expansion rates for indeterminate districts)			
Kings		Cohos	
2013	2014	2013	2014
751	365	97,325	94,107

Increasing Our Returns

Our challenge

Despite the substantial and increasing contributions the Port Armstrong Hatchery has been making to the common property fisheries since its start 34 years ago, we have become concerned about an apparent downward trend in the strength of our returns. Marine survivals have fluctuated strongly year to year in response to varying near-shore and ocean conditions but have slowly declined on average.

AKI has analyzed its fish culture techniques and production procedures in great depth and concluded that the hatchery staff has been employing exemplary and steadily evolving fish culture practices during the past decade. We have also



witnessed similarly weak wild harvests during these same years in lower Chatham Strait along the Baranof shore. Specific areas within Alaska and within Southeast itself undergo unpredictable cycles in marine survivals, and it is likely that natural conditions are the main cause of our relatively disappointing recent returns.

Production increases

Nonetheless, AKI is currently making a top priority of increasing our returns. We are taking a two-pronged approach: 1) increasing our production, and 2) spreading out our releases. The first strategy is relatively straightforward, and AKI has obtained permit increases for both pinks and chums in the past year. In 2014 ADF&G approved a 20 million egg increase

Port Armstrong pink and coho net pens.

Photographer unknown

in our pink permit to a total of 105 million green eggs. This spring we also doubled our chum permit from 30 to 60 million green eggs. These increases require significant capital expenditures for facility space, plumbing, incubators, net pens and the like, along with operational costs of additional feed and labor.

At this point, our coho and king production is limited by the amount of fresh water available for rearing at Port Armstrong, at least for conventional rearing techniques. The hatchery staff has been testing a variety of water-saving techniques for increasing production of cohos and kings, and we're optimistic about some of the results we're seeing so far. In years of low as well as high marine survival rates, adding to our rearing and releases should generate more adult fish to benefit both common property and cost recovery fisheries.

Boosting marine survivals

The second component of our new initiatives, spreading out our releases, is aimed directly at boosting our marine survivals. We have postulated four possible causes for the long-term decline: a) unfavorable environmental conditions for the first few weeks of rearing along the western Chatham Strait shore, as noted above; b) growth of predator populations targeting the Port Armstrong releases; c) short-term overcrowding of the near-shore marine rearing habitat as production has increased; or d) predation on the pink fry by our expanded coho releases. Of these four possibilities, the only one that we cannot influence is the general environmental conditions of the area. In contrast, the last three factors may all be addressed by remote releases of the Port Armstrong fry.

Remote release pinks

With the increase in our pink permit, we have secured permission to release up to 55 million pink fry in Port Herbert, which lies about nine miles north of Port Armstrong along the Baranof shore. The intention with this remote release is simply to try to boost our pink marine survivals by releasing a significant portion of our Port Armstrong production away from the hatchery. Like the pinks released at Port Armstrong, these pinks are expected to make a significant contribution to seine fisheries along the shore of Kuiu Island.

We had made preparations to do our first release there this spring, including the fabrication of deck-loaded transfer tanks from surplus Medvejie Hatchery raceways generously donated to us by NSRAA. But with the unfortunate sinking of our usual contract vessel, the *Eyak*, just before transport time this winter, we decided to postpone the remote rearing for this year. Instead, we ended up hopefully accomplishing the same objective by towing several of our pink net pens out into Chatham on the ebb tide and floating them toward the open ocean before pulling the nets and letting the fry go.



M/V Afognak towing net pens in Chatham Strait during a pink release, May 2015.

Photo by Josh Besecker



Dave Nicolls cleaning raceways. Photo by Bart Watson

This fry release is fundamentally different in that the fry may end up avoiding the most intense near-shore predators altogether and get out to sea where the predator population is less dense. Based on original studies carried out in Puget Sound, fisheries biologists long assumed that pink salmon fry required a near-shore rearing habitat to attain a certain size before heading out to the ocean, but more recent studies from Prince William Sound revealed that a sizable contingent of the pinks there go straight out without rearing in the near-shore environment. The Port Armstrong Hatchery's different pink groups were marked with separate otoliths marks, and it will be most interesting to see what the marine survivals of these towed pinks are in comparison with the ones released within Port Armstrong.

Port Lucy chums

Our chum permit increase was accompanied by permission to release up to 30 million chum fry in Port Lucy, the bay immediately to the north of Port Armstrong. After we have installed the infrastructure for the remote rearing there, we intend to saltwater rear and release half our chum fry in each location. It will also be interesting to see whether we achieve increased marine survivals at this remote release site, even though it is very close to Port Armstrong.

Establishing multiple release sites can be an advantage in and of itself, since other hatcheries have found that one site will do better in some years and another will do better in other years. In any case, the primary long-term goal of the Port Lucy release is to establish a new chum terminal troll harvest. The bay is long, straight and deep, with no significant wild runs, and should be just about perfect for a concentrated troll fishery. Because our chum stock (obtained from NSRAA and Gunnuk Creek, and nearly the same timing, size and quality as Hidden Falls) returns in July, when that shore of Baranof is always closed to seining, the new terminal harvest should not create any gear conflicts.

It will take several years to produce large enough runs to attract a critical mass of trollers and processors to launch a meaningful terminal common property harvest, but we're finally on our way toward that goal. When stabilized at full production, we believe the establishment of this terminal troll chum fishery will make a significant and measurable contribution to the fleet by providing additional fishing opportunities and helping to spread out the region-wide troll effort from other terminal chum troll fisheries taking place at about the same time.



Ian Fisk sorting otoliths. Photo by Bart Watson

Innovation

One of the unique aspects of Port Armstrong Hatchery is our self-sufficient lake-fed hydropower system. Not only are we “off-grid” and generating our own electricity, but our load banks controlling the electrical output also end up generating heated water that we can put to use for fish culture. This warm water has enabled us to pursue several interesting fish rearing strategies:

Early chum ponding

After experimenting for several years with “large/late” fry in an effort to boost marine survivals but seeing no benefits, we have more recently focused on a “large/early” rearing strategy, releasing the fry at a time of year closer to wild outmigrations. In recent years, warmer fall seasons have given our chums a head start on their growth. We have been able to build on those favorable environmental conditions by making use of our heated water to further accelerate the chum eggs. This past winter we saltwater ponded our chum fry (i.e., put them in net pens) in December, a few months earlier than most hatcheries. We released them this April at an average size of 3.04 grams, with several net pens of our largest fry averaging 4 grams. These fry are more than twice the size we normally achieved before using the heated water from our load banks to speed up the incubation. Additionally, we plan to install a fifth hydro turbine in 2015, which should provide sufficient energy to double the amount of warm water available to use for our fish culture.

King zero check program

By using heated water in our king incubation and rearing, we are emulating natural conditions further south in the range of the species, where the water is generally warmer and kings often “zero check” in the wild. Because the heated water is free for us, as a by-product of our hydropower system, producing king zero checks is more affordable at Port Armstrong than it is at most other hatcheries. This is the ninth year we have released zero check kings, experimenting with a wide range of release sizes in various years. We’ve been able

to get our zeros up to 20 grams at release, and we now have a range of several age classes of kings out at sea with different sizes at release. When we’ve ultimately received all the returns from these experiments, we’ll have gained an excellent idea of what release size and level of production is optimum and whether it’s worthwhile to expand this program. If it proves successful, the zero check program has the potential to significantly increase the number of kings available for harvest at a fraction of the cost required to produce the traditional smolts.

Coho acceleration

In the meantime, we have another use for the warm water from our hydro system. While we wait for returns of our zero check kings, we are focusing more on increasing coho survivals. Port Armstrong releases approximately 2.5 million coho smolts annually, and we’re beginning to experiment with accelerating their growth with heated water too. Coho aren’t biologically suitable for zero-checking, but we are initially aiming for 35 grams by release time in late



West Hydro building at Port Armstrong. Photo by Bart Watson

May, rather than the typical 20 to 25 gram target. We would like to test various smolt sizes and eventually see how large we can get test batches in separate raceways or net pens, while avoiding overcrowding. Our goal is to discover the sweet spot for average smolt size at release versus the number that we can rear in our limited water and space, in order to produce the greatest number of returning adults.



Aerial view of Port Armstrong Hatchery. Photo by Ian Fisk

Fresh water availability is a common limitation at most hatcheries, and Port Armstrong is no exception. For the past few years we have been successfully transferring half our cohos in the fall into saltwater net pens without freshwater lenses in order to circumvent our water limitations and increase our production further. This coming fall we are also planning to introduce a small experimental batch of our one-year old cohos into saltwater net pens in August rather than the usual October. If that strategy proves successful, we will reduce our major freshwater bottleneck that occurs annually in September, when the water is still warm and the coho pre-smolts are growing rapidly, and densities in our raceways reach critical levels. There is always a complex mix of different rearing and release strategies combined with annual environmental variations that makes fish culture an ongoing challenge and a real art. As we log the varying marine survivals each year and gradually build a database of which strategies prove most successful over time, we can step by step convert the art into a science.

Electro-anesthesia

In 1994, the Port Armstrong Hatchery was as far as we know the first in Alaska to adopt this efficient method of stunning fish for spawning. We discovered that Washington State hatcheries had put electro-shockers to use in taking eggs from king salmon, which are very difficult to hold during the spawning process due to their great size and strength. At that time, we and other Alaska hatcheries employed teams of temporary egg-take employees outfitted with wooden clubs to subdue all our salmon before passing them over to their coworkers removing eggs and milt. The clubbing technique was expensive, slow, messy and often resulted in repetitive stress injuries for the workers. For a couple of years the Port Armstrong crew switched to snapping pink salmon necks with a flip of the wrist -- a skilled employee could kill four pinks simultaneously, two in each hand -- and significantly sped up the process.

But when we heard about the electro-shocker, we thought we could adapt it to the high volume production typical of Alaskan pink and chum hatcheries and took the plunge. The machine required a great deal of tweaking initially to get the shape and magnitude of the electric shock just right, in order to stun the fish without doing any damage to the eggs. We also had to experiment with the crowders in our raceways to push the right number of fish into the "shock box", which has to be insulated from the rest of the water system in order to deliver the electric charge. The manufacturer spent a fair amount of time working with us to get the system operating smoothly, and the method rapidly spread to other hatcheries soon afterwards. Electro-anesthesia is now the standard methodology used in hatcheries statewide.

The thrust of all of these innovative techniques is to take advantage of our site's unique characteristics and help us achieve our goal of increasing marine survivals and contributions to the commercial harvest. Like any science, it takes a lot of trial and error and constant updating of techniques to improve enhancement. Each hatchery in Alaska experiments in its own ways, and this diversity of approaches and subsequent sharing of results leads to progress for all hatcheries and better results for Alaska's fisheries.

The Port Armstrong Hatchery Community



AKI board members with Port Armstrong Hatchery staff and community residents.

Photo by Ralph Wells

AKI Staff Members

Administrative Office

Bart Watson, *General Manager*

Tim Blust, *Business Manager (part time)*

Ian Fisk, *Assistant General Manager (part time)*

Ian Thrower, *Administrative Assistant*

Port Armstrong Hatchery

Ben Contag, *Hatchery Manager*

Justin Rose, *Assistant Hatchery Manager*

Shannon McMillan, *Maintenance Manager*

Dave Nicolls, *Fish Culturist III*

Kevin Whitcomb, *Maintenance Tech III*

Chuck Wlasniewski, *Fish Culturist I*

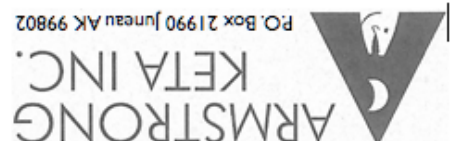
Current temporary employees:

Josh Besecker, Lavon Contag,

Debra Rose, Courtney Stein,

Mike Upcraft and Mark Young

AKI BOARD MEMBERS



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