Reducing Chinook Salmon Bycatch with Market-Based Incentives: Legacy Allocations of Individual Tradable Encounter Credits (ITEC's)

How Legacy Allocations and Trading of ITEC's Effectively Address The C-2 Motion PPA Requirements

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ICA requirements to participate in the 68,392 hard cap scenario
(as specified in the PPA)

I.   An ICA must provide *incentive(s)* for each vessel to avoid salmon bycatch under any conditions of pollock and salmon *abundance* in all years.

II.   Incentive measures must include *rewards* for salmon bycatch avoidance and/or *penalties* for failure to avoid salmon bycatch *at the vessel level*.

ICA requirements to participate in the 68,392 hard cap scenario
(as specified in the PPA)

III. The ICA must specify how those incentives are expected to promote reductions in actual individual vessel bycatch rates relative to what would have occurred in absence of the incentive program. Incentive measures must promote salmon savings in any condition of pollock and salmon abundance, such that they are expected to *influence operational decisions at bycatch levels <u>below</u> the hard cap.*

Summary of the C-2 Motion PPA Incentive Requirements

1) Provide incentives at the _individual vessel level._

2) _Reward_ vessels that successfully avoid Chinook and/or _penalize_ vessels that fail to avoid chinook.

3) Incentivize vessels to avoid Chinook bycatch at _all levels_ of abundance in _all years_.

4) Incentives must influence fishing decisions _at levels below the hard cap_.

ITEC Legacy Program

ITEC = individual tradable encounter credits

- Creates forward looking incentives to reduce bycatch this year by <u>rewarding and penalizing</u> vessels through adjustments in subsequent annual credit allocations (ITEC is like **insurance** where the costs of not having enough is high).

- Effective <u>at all levels of salmon abundance</u> (most effective at low salmon abundance levels).

- Rewards and penalites of trading ITEC provide stronger incentives to reduce bycatch.

Overview of the ITEC Legacy Allocation Program

- *Reward* individual vessels having a record of low bycatch rates with additional allocation of chinook salmon encounter credits (ITEC), and the opportunity to sell credits.

- *Penalize* individual vessels with high bycatch rates with reduced ITEC (individual tradable encounter credits) and the need to buy credits.

- Chinook Salmon *bycatch declines* cumulatively through time as more ITEC ends up in the the hands of vessels with a demonstrated record of good behavior.

Legacy Program

How it works:

1) Sectors are given fixed annual allocations of encounter credits (ITEC) according to the C-2 PPA.
2) These are then distributed to the *individual vessels* via the coops according to a <u>uniform ITEC allocation formula</u>. This formula adjusts allocations year to year to <u>*reward*</u> good behavior and <u>*penalize*</u> bad performance.
3) The uniform ITEC allocation rule is designed to minimize the effects of chance encounters (bad luck) and highlight consistent good/bad *behavior*, putting more credits at the disposal of *consistent* good players.
4) Vessels can use or buy/sell ITEC across participating sectors to off-set variable chinook salmon encounters.

Legacy Program

How it works: (cont'd)

5) Efficient vessels with surplus ITEC credits are <u>rewarded</u> with extra revenue by being able to sell ITEC, while vessels with high bycatch rates who run out of credits are <u>penalized</u> by needing to purchase additional ITEC, if available and affordable.

6) The price of ITEC credits is determined by market forces. The costs of insufficient ITEC due to poor behavior can be large.

7) Vessels who run out of credits must <u>stop fishing</u>. They can resume fishing only after buying sufficient ITEC to cover expected fishing activity. Accidental shortfalls need to be covered by purchase.

Legacy Program

How it works: (cont'd)

8) Vessels with low bycatch are net sellers of ITEC, and those with high encounter rates are potential buyers of ITEC.

9) ITEC has more value to vessels with low encounter rates because each credit represents more pollock revenue.

10) ITEC has less value to vessels with high encounter rates.

11) Clean vessels will be sellers of ITEC, and will inevitably set the price.

ITEC Legacy Allocation Formula

The <u>legacy allocation formula</u> accounts for 3 weighted factors at the *individual vessel level:*

1) Amount of pollock originally assigned to the vessel

2) Legacy of ITEC or vessel's past record of bycatch performance (a bycatch "track record")

3) Current bycatch performance relative to the others in the sector.

Uniform ITEC Allocation Formula:
determines proportional credits allotments

$$P_{t\,=}\,1/3 + 1/3\,P_{t-1} + 1/3\,Q_{t-1}$$

constant factor
(pollock)

"legacy" component
(bycatch track record)

bycatch function
(penalty/reward)

ITEC allocations are done pro-rata to pollock quota

How it works

The legacy allocation rule is designed to minimize the effect of chance encounters (bad luck) in any year and highlight consistent good/bad behavior, putting more credits at the disposal of consistent good players.

-This creates incentive for consistent good performance.

-This reduces fleet bycatch cumulatively through time.

-Incentives are the same every year, from the start of the program.

A Simplified Example

- Year 1– Vessel Y receives salmon credits pro rata to its pollock allocation. Say **300** credits for the year

- Year 2 - Vessel Y fished "year 1" with a low bycatch rate that put it at the top of the pack and receives **67 bonus** credits. The total credits allocated to vessel Y for this year is **367**.

- Year 3 - Vessel Y had an above average "year 2" and fished with a bycatch rate nearer the middle of the pack. It receives **49 bonus credits** for this year, but because of the *legacy component* the total credits allocated to Y for this year is **371**.

A Simplified Example

(Cont'd)

Year 3 - Vessel Y received **49 bonus credits**, with *legacy component* the total credits allocated was **371**.

- Year 4 - Vessel Y had an average "year 3" with a bycatch rate near the middle of the pack. It receives **0 bonus credits** for this year, but because of the *legacy component* the total credits allocated for this year is **324**. (not 300)

- Year 5 - Vessel Y had another average year with a bycatch rate near the middle of the pack. It receives **0 bonus credits** this year, but the *legacy component brings* Y's total credits to **308**. (not 300)

Simplified Example

	pollock	"Legacy"	"Bycatch"	total
2003	100	100	100	300
2004	100	100	167	367
2005	100	122	149	371
2006	100	124	100	324
2007	100	108	100	308

The Legacy Allocation Formula:

1) Has a <u>ceiling and floor</u> (bounded range) to credits allocations. For example, one cannot lose less than **X%** of initial allocation and cannot gain more than **Y%** of initial allocation.

2) More sensitive during times of low salmon encounter. (PPA- affects operating decisions at all levels of encounter)
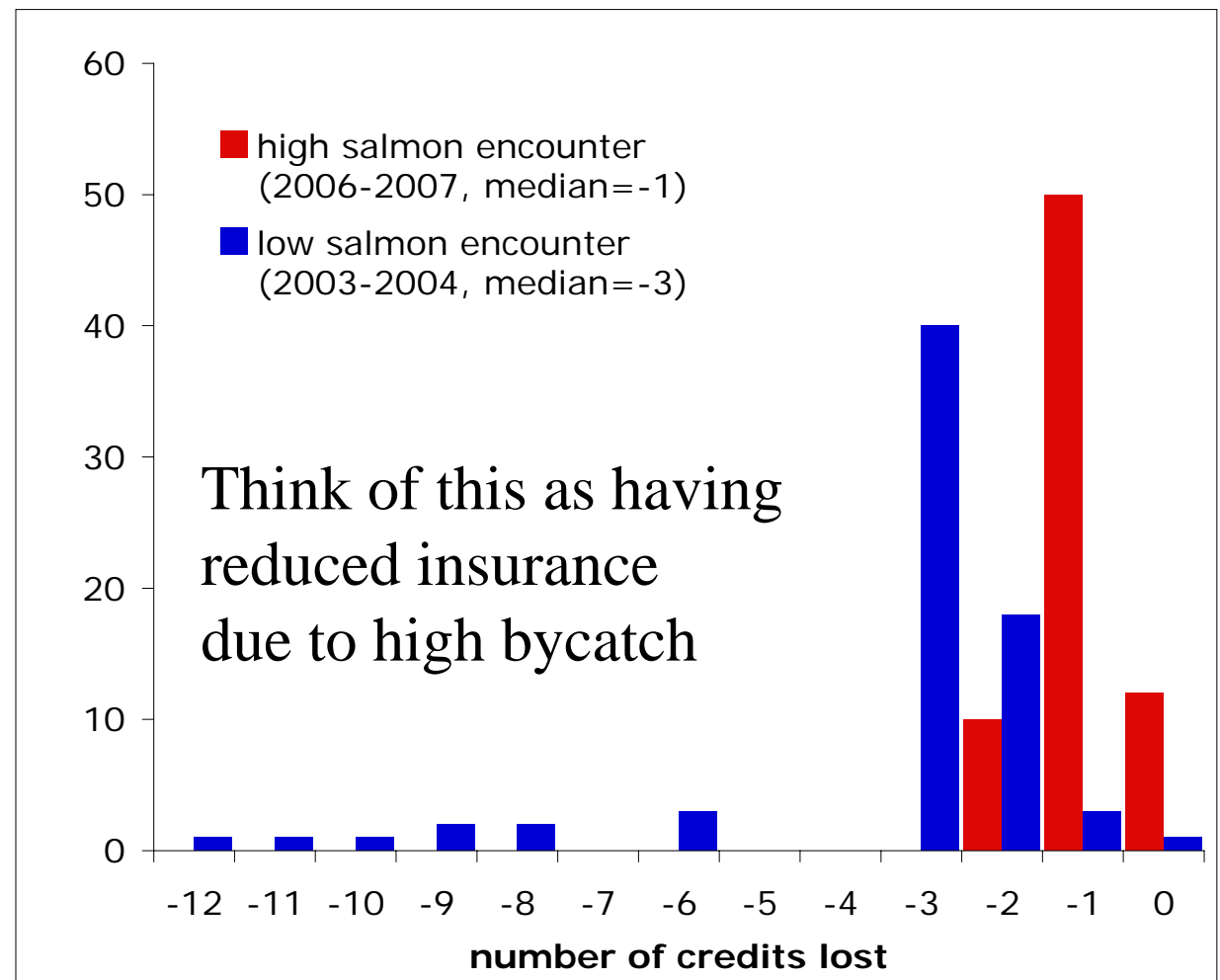
• Legacy Program

Individual Vessel Incentives - Rewards: There is more reward incentive to avoid bycatch during low chinook salmon encounter years (blue).

Think of this as gaining additional insurance by fishing cleanly
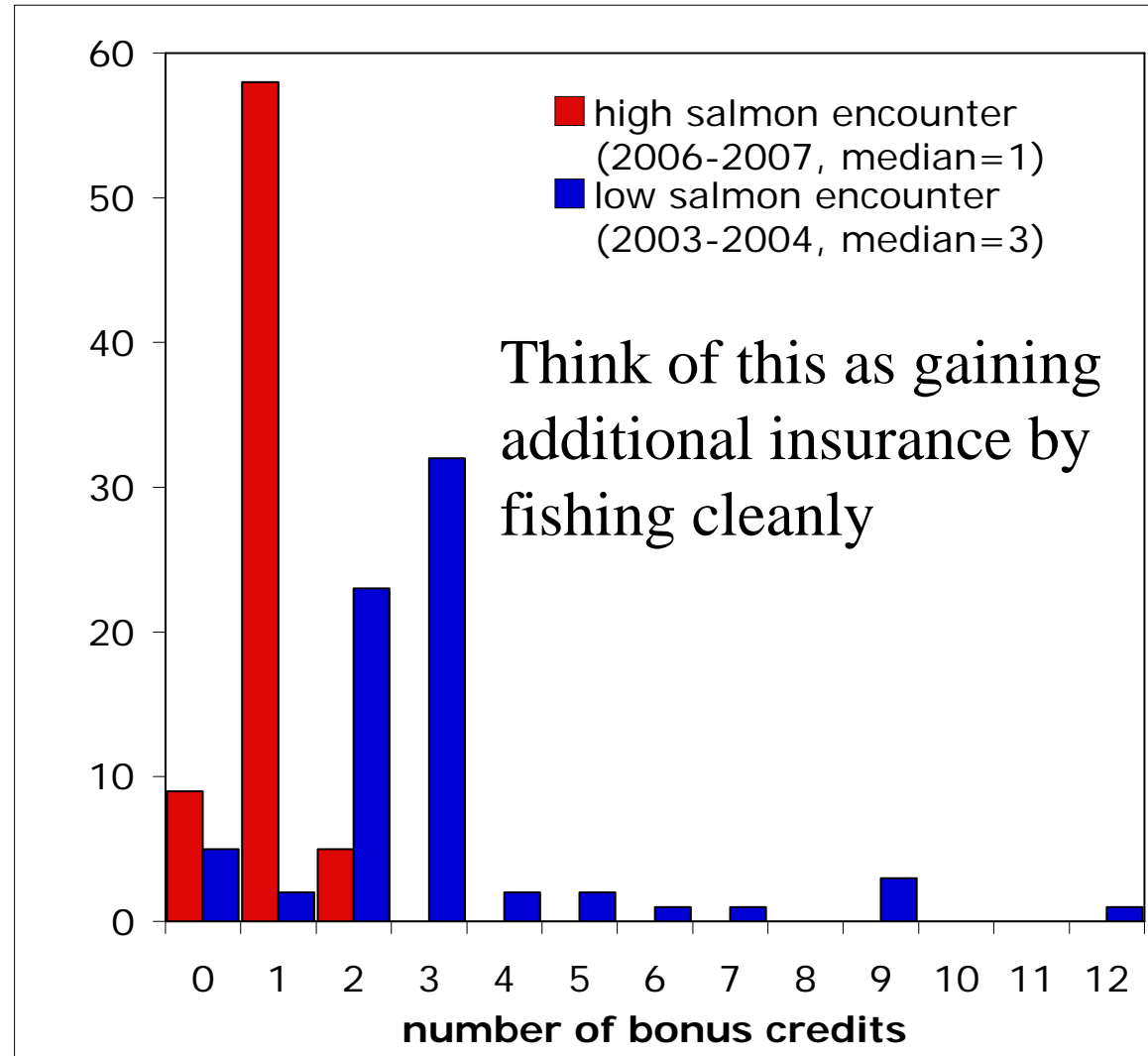
• Legacy Program

<u>Individual Vessel Incentives - Penalties:</u> Every vessel's future allocation of ITEC is at risk of being reduced if their relative performance is poor. This penalty is greater during low salmon ecnounter years (blue).

high salmon encounter
(2006-2007, median=-1)

low salmon encounter
(2003-2004, median=-3)

Think of this as having
reduced insurance
due to high bycatch

number of credits lost

Does the ITEC legacy program meet the C-2 Motion PPA incentive requirements?

✓ Provide incentives at the _individual vessel level._

✓ _Reward_ vessels that successfully avoid Chinook and/or _penalize_ vessels that fail to avoid chinook.

✓ Incentivize vessels to avoid Chinook bycatch at _all levels_ of abundance in _all years_.

✓ Incentives must influence fishing decisions _at levels below the hard cap_.

- Legacy Program

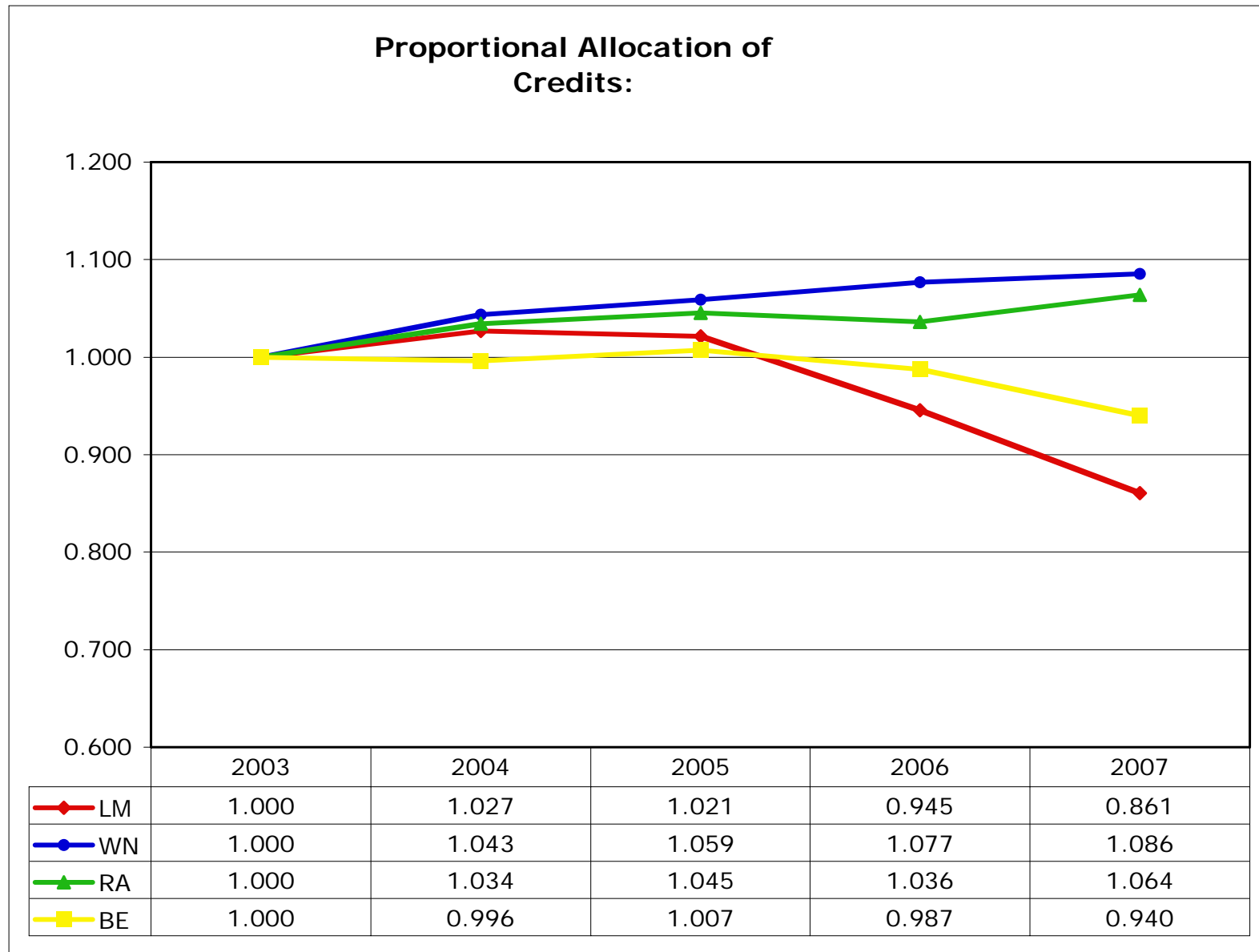# How BIG are Individual Vessel Incentives?

-Long Term Incentives: (ITEC adjustments)

       -most effective in low encounter years

-Short Term Incentives: (trading)

       -strongest in moderate to high encounter years

How Big are Long-Term Incentives?

Proportional Allocation of Credits:

	2003	2004	2005	2006	2007
LM	1.000	1.027	1.021	0.945	0.861
WN	1.000	1.043	1.059	1.077	1.086
RA	1.000	1.034	1.045	1.036	1.064
BE	1.000	0.996	1.007	0.987	0.940

*Based on actual historical data on 4 inshore vessels (no incentives operating)

How Big are Long-Term Incentives?

With extra legacy credits from fishing cleanly in 2003 and 2004 these vessels were allowed to capture significant additional revenue per credit. The PPA hardcap was exceeded in 2005.

Vessel	2005 credits gained/lost	Net Gain/Loss due to Legacy Reallocation
LM	0	$0.00
WN	11	$53,233.77
RA	24	$116,146.40
BE	9	$43,554.90

Again, the gains shown here reflect a legacy of relatively low bycatch behavior in the preceding low abundance years (here 2003-2004).

On average vessels gained or lost 12 credits in 2005

How Big are Long-Term Incentives?

The PPA Hardcap was exceeded here too. ITEC credits would be hard to purchase, and would be very expensive.

Vessel	2006 credits gained/lost	Net Gain/Loss due to Legacy Reallocation
LM	(6)	($23,856.36)
WN	11	$43,736.66
RA	20	$79,521.20
BE	10	$39,760.60

How Big are Long-Term Incentives?

The costs in each of these years is in terms of unfished pollock under the PPA hardcap would have been considerable for the Inshore sector.

Without legacy allocation which puts more insurance credits (ITEC) in the hands of the cleaner more efficient vessels, costs would have been much worse under the PPA hardcap

Vessel	2007 credits gained/lost	Net Gain/Loss due to Legacy Reallocation
LM	(21)	($58,184.09)
WN	17	$47,101.41
RA	35	$96,973.49
BE	(29)	($80,349.46)

Cumulative long-term incentives:

• Again the long term incentives provided by the legacy allocation program act <u>cumulatively</u> (GPA) to encourage <u>consistent</u> long-term reductions in chinook salmon bycatch.

• It is not a one-shot deal, but promotes consistent overall change toward increasing industry efficiency.

Short-Term Incentives: Trading

• Clean boats will be net sellers of ITEC.
   -Clean boats will set the price for ITEC.

• A clean boat catches more pollock per salmon, thus a credit is more valuable to a clean boat.

• Credits are almost always limiting, and will be most expensive at the the beginning of the season.

• More vessels than anticipated would run out of ITEC under the PPA hardcap in low to moderate encounter years.

Trading is Necessary Under the PPA Hardcap

| year	# of Inshore sector vessels that run out of credits
2003	11
2004	33
2005	37
2006	54
2007	56

- # Legacy Program

Trade Generated Incentives

- ✓ Strong incentives to fish clean in order to be a seller, not a buyer, of credits.
- ✓ Buyers may be doubly penalized by the cost of buying additional credits and the reduction of future allocations under the Legacy Program
- ✓ Creates a fair way to handle unfortunate bycatch circumstances

• Legacy Program:

Hypothetical Simulation of
Cumulative Allocation and Trading Incentives Inshore Only
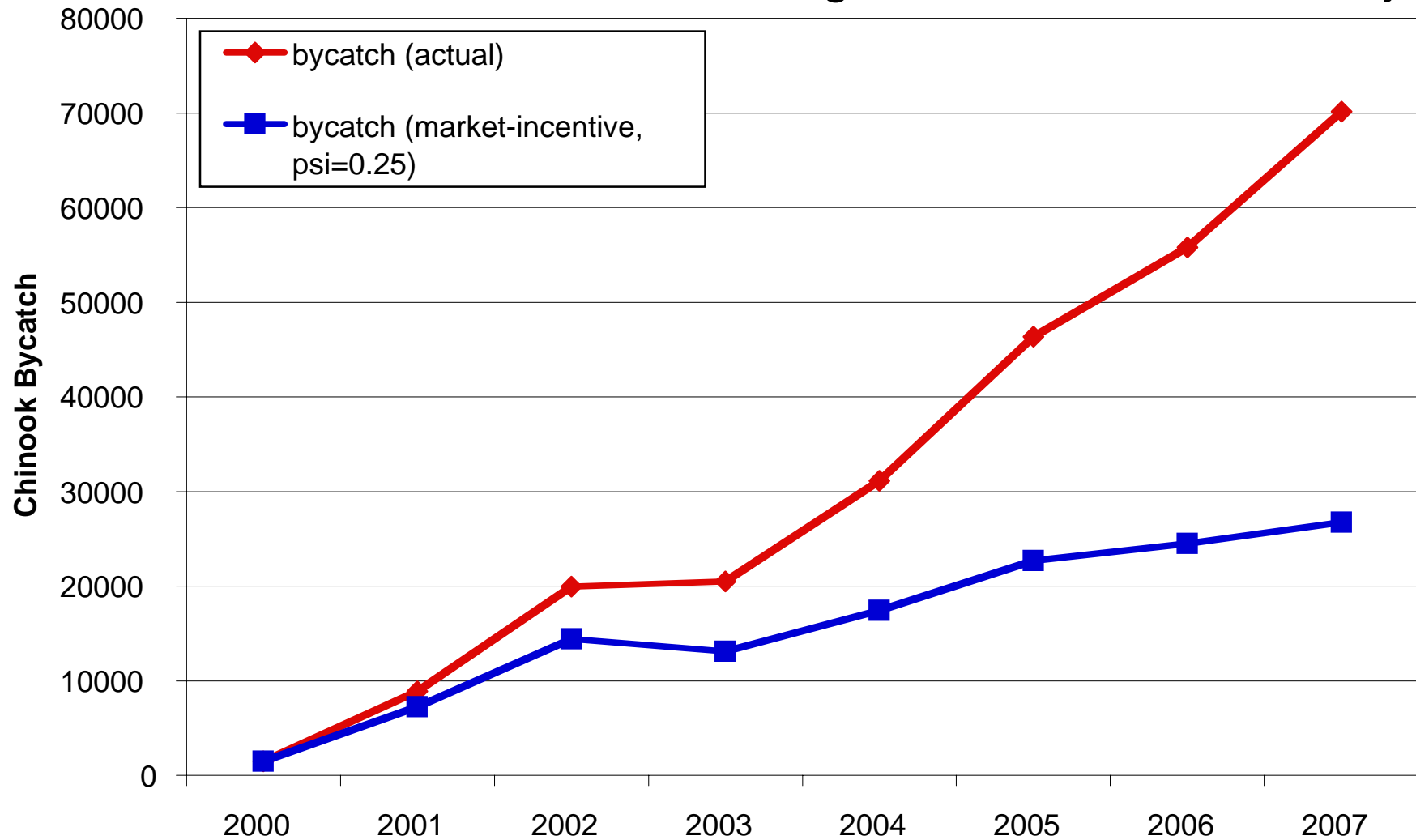
• Legacy Program

Individual Vessel Incentives from ITEC

Allocations:

- Every vessel's future allocation of credits at risk of being reduced regardless of the number of salmon taken
- Creates consistent (<u>cumulative</u> track record) behavior that will conserve available credits due to unknown future needs
- Rewards the best performing vessels with additional future bycatch credits
- Penalizes poor performing vessels by reducing future bycatch credits
- Incentive strongest during low encounter years