When salmon are rare:

The detrimental impacts of bycatch are largest when Chinook are rare. A fixed hard cap or semi-fixed performance standard (e.g. a bycatch target of 47,591 with a fixed hard cap of 68,392) punishes the pollock industry most severely when Chinook need least protection and offers no penalty when salmon are rare, creating incentives that are unresponsive to underlying salmon abundance. Indeed, incentives under these schemes can be zero (or worse) when Chinook are rare, producing bycatch rates much higher than expected. In addition, they may be extremely prejudicial to the pollock fishery, which will leave a lot of catch on the table, without really addressing the Chinook conservation interests. Such plans are not reasonable management strategies. Partly to address this problem and build a more rational solution, the Northern Pacific Fisheries Management Council has arrived at the C-2 Motion Preliminary Preferred Alternative (PPA) Incentive Requirements (see Box 0).

Here we examine a market-based bycatch plan, using individual (vessel-level) tradable encounter credits (ITEC), that addresses the incentive requirements of the C-2 Motion PPA. This recommended approach is shown to provide robust vessel-level incentives to reduce Chinook salmon bycatch under all levels of Chinook and Pollock abundance[[1]](#footnote-1) and can act cumulatively through time through consistent competition to further reduce overall fleet Chinook encounter rates. The plan is flexible, and with experimental implementation and monitoring can be tuned to meet any serious performance standards.

Summary of the C-2 Motion PPA Incentive Requirements

1. Provide incentives to avoid bycatch that operate 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.*

Box 0: C-2 Motion PPA

In this plan, different sectors of the fishery are given fixed annual allocations of salmon encounter (bycatch) credits (1 ITEC = 1 Chinook) in amounts as described in the C-2 motion document under the industry-wide hard cap of 68,392. These are then distributed to individual vessels via the fishing vessel cooperatives according to a specifically designed uniform allocation rule (the Legacy Allocation Rule) that provides vessel-level incentives to avoid Chinook salmon encounters and explicitly addresses each of the C-2 motion requirements. Vessels can use or trade credits within and across sectors to offset salmon bycatch encounters and these transfers of ITEC are moderated by rules that further strengthen C-2 incentives and prevent potential abuses (e.g. Dynamic Salmon Savings[[2]](#footnote-2)).

**In overview**, this plan is designed to ***reward***individual vessels with low salmon bycatch levels, by: (1) providing higher credits allocations in the subsequent year (“bonus credits”), and (2) creating an additional source of revenue, through the selling of excess credits to vessels that need them. Conversely, it ***penalize****s* vessels with high bycatch levels by: (1) decreasing credits allocations in the subsequent year (“credits penalty”), and (2) requiring vessels that have run out of credits to decide to either buy credits or lease their shares of pollock catch to vessels with lower bycatch that have extra ITEC.

**The main objective of this plan** is to create cumulative financial incentives for a fleet-wide reduction of salmon encounters that satisfies the C-2 Motion requirements. In particular, it provides incentive for continuous behavioral improvements at the individual-vessel level to reduce Chinook bycatch in order to minimize lost revenues due to un-harvested pollock if Chinook limits are hit. That is, *it minimizes industry losses due to unfished pollock while encouraging continual competitive evolution toward diminishing overall Chinook bycatch.*

**The two main components** of the plan are the Legacy Allocation component (rules to reallocate ITEC among vessels: address long-term financial incentives) and the Transfer component (rules to regulate ITEC trading between vessels: address both long and short term financial incentives).

**The Legacy Allocation component** reallocates ITEC away from vessels with higher encounter rates toward cleaner fishing vessels. It creates long term “insurance-like” incentives against catastrophic revenue losses that could occur under the PPA hardcap at times of moderate to high Chinook encounter levels. A particular strength of the Legacy Allocation scheme is that the incentives to avoid bycatch are strongest in years of low salmon abundance, when Chinook populations may be most fragile. These are times when the credits also have a higher intrinsic fishery value (not market value) due to the higher value of Pollock harvested per Chinook encounter, implying a higher theoretical upper bound on ITEC market value). Legacy-based reallocation depends on the past record of performance to determine current allocations (akin to a grade point average). This cumulative record creates inter-annual accountability, and dampens the effect of occasional chance events (bad luck) that are *not* due to individual vessel behavior. It emphasizes the *behavioral* component of vessel bycatch rates and minimizes the effect of *chance* encounters. Legacy Allocation creates a cumulative incentive for individual vessels (and hence, the fleet) to adopt consistent behaviors to reduce overall bycatch and its associated costs.

**The Transfer component** of the Recommended Industry Market Incentive Plan provides provisions for regulating trading of ITEC between individual vessels. These are designed specifically to: 1) discourage chronic bad players who place a drag on the fleet, 2) to reinforce the C-2 motion individual incentive requirements, and 3) to specifically keep the realized bycatch far below the hardcap whenever possible (i.e. through Dynamic Salmon Savings). The Transfer component limits the number of credits that a vessel can purchase and significantly reduces the excess supply of credits especially during low abundance years (per the C-2 motion). It reinforces the long-term incentives of the allocation scheme as well as the short-term incentives created by trading ITEC by promoting higher credits prices in times of low encounter rates.

**Auxilliary Features of the plan**:

1) An industry sponsored research component to monitor and evaluate the Legacy Market Incentive Plan performance in reducing bycatch as well as funding to obtain basic information on Chinook population dynamics (eg. runs counts and stock assessments) to better understand the impacts of the Pollock Industry on Chinook populations.

2) The implementation of a fixed fishing closure area (currently referred to as the Chinook Conservation Area).

3) Implementation of a 2-strikes rule to weed out chronic offenders.  
4) A 3% emergency fund saved as a tax by the coop or sector to safeguard against genuine bad luck encounters

**Auxilliary Benefits of the plan**:

1) Perhaps the greatest long term benefit of the ITEC trading and allocation plan is the establishment of an independent (certified) organized market place for conducting fishery business. This infrastructural cornerstone would be likely find support from outside sources. It would represent a significant step forward toward market efficiency and transparency and would be scalable to other bycatch issues and the trading of financial instruments to control risk.

2) Finally, along with transparency this system will provide natural price signals for the value of bycatch, in terms of the risk and costs of forgone Pollock when ITEC become limiting. A major strength of this system is that the penalties and rewards are tied naturally to the actual market value of bycatch to the Pollock industry.

1. Note that while the PPA wording uses *abundanc*e, bycatch rate or *encounter rate* is the defacto proxy for Chinook abundance (bycatch rate = [# Chinook caught] / [1 metric ton of Pollock]). [↑](#footnote-ref-1)
2. Dynamic Salmon Savings retires a variable fraction of the excess ITEC remaining after each vessel has completed its Pollock harvest, diminishing the supply of tradable credits in low to moderate encounter times. [↑](#footnote-ref-2)