

On-board Histamine Control and Monitoring Model for Albacore (*Thunnus alalunga*) Troll Fisheries

Fishing Methods:

Trolling with 4 to 14 or more lines, using artificial squid jigs. Fishing is done at the surface and takes place during the summer months, June through October, in the Pacific Northwest. Air temperatures are usually between 55-70°F and water temperatures between 55-65°F.

Target Species:

Albacore tuna (*Thunnus alalunga*), also referred to as long-fin tuna, 2 to 5 years in age with an average weight between 10 to 20 pounds.

On-board handling methods:

Albacore are caught at the surface by trolling artificial jigs behind the vessel at speeds between 5 and 6 knots. The lines are pulled by hand and/or reeled in by hydraulic pullers, taking 15 seconds to several minutes depending on line length and ocean conditions. The fish are pulled to the transom and then manually lifted over the transom on to a landing table. Once on the landing table they may be left whole and un-bled or undergo one of several handling techniques, depending on the target market and type of refrigeration used on the vessel. On-board handling techniques vary from boat to boat but may include one or a combination of the following procedures:

- Bleeding- fish are normally bled at the gills and/or throat-latch.
- Immobilization- brain spiking
- Hanging- fish are bled while hanging by the tail, instead of laying on their side, and may be frozen while hanging (keeps fish straight which may reduce processing time and increase yield)

Fish are not eviscerated on-board the vessels and are delivered shore side as whole fish. Albacore are typically found in large schools and many can be captured within a short period of time. Periods of heavy activity may be followed by periods where few fish are captured. During these lulls fish are usually placed into storage. Fishermen can capture up to 500 fish per day depending on conditions with high catches primarily made up of smaller fish, 8 to 12 pounds (referred to as “schoolies”). Days with catches over one ton are considered successful.

Chilling Methods:

After the fish are landed and the initial handling techniques completed, they are allowed to bled and/or cool on deck. Fish may be cooled during bleeding or placed in chilling systems after bleeding. Cooling techniques vary by vessel and may include ambient air circulation, ambient seawater spray or immersion, refrigerated seawater (RSW), chilled (iced) seawater

(CSW), or super-chilling (which uses additional salt and ice to lower the freezing point of seawater). Most vessels do not use RSW, CSW or super-chilling and fish are generally air cooled or sprayed with seawater then placed into storage after bleeding has been completed or time allows.

Storage Methods:

There are currently three storage methods used in the Albacore fishery. These consist of ice (considered fresh fish), spray-brine or air-blast freezing systems. Fish can be placed into storage and stacked immediately or frozen first and then stacked. Some fishermen use horizontal racks or hang fish by the tail to freeze the fish more rapidly then stack the fish once they are frozen (usually after spending over night on the racks). The amount of warm fish placed into storage effects the ability of the freezing system to maintain low temperatures and some fishermen will stop fishing if they reach maximum capacity for their system. The temperatures during storage may range from 0° C, for ice boats, to -10° to - 20° C for spray-brine or air-blast freezers.

Off-loading methods:

Fish are loaded by hand into totes and lifted out of the holds for transfer to another facility or directly into the processing plant. Some fishermen utilize direct marketing and sell, either iced or frozen tuna, to consumers from their mooring at port. Increasingly, more home canners and micro-canners are buying directly from vessels that provide high quality albacore.

Time-Temperature controls:

Time-Temperature monitoring is very limited within the Pacific Northwest albacore fishery. Fresh fish (which make up less then 10% of landed fish) are stored in ice and shipped locally, either in ice or in refrigerated trucks, with time-temperature depending solely on the amount of ice supplied. These fish must be caught and utilized within 7 to 10 days to insure freshness. Frozen fish, spray-brine or air-blast, have very limited time-temp monitoring. Typically the only temperature monitoring and control is done by looking at the real-time temperature gauges located in the hold and displayed in the wheelhouse. This information is rarely recorded and transferred to the buyer. Most transport and processing facilities have temperature controls but time-temperature profiles are not generally available at any step in the food chain. Currently core temperatures, if desired, are taken at port by the buyer, which does not give any indication on how fast the fish was cooled and if the temperature of the hold remained constant (within limits).

Monitoring time and temperature:

Fish and storage hold temperature monitoring:

Time-temperature monitoring devices, or data-loggers, are available (i.e.- HOBO data-logger by Onset Computer Corp.) in several configurations and temperature ranges. These can be used to monitor the temperature of the hold and/or the internal temperatures of individual fish

giving a complete temperature profile during the cooling phase and once frozen. Small, quarter size, temperature loggers are available that can be inserted directly into the fish, however once the fish is frozen they are difficult to remove and may have to be removed by the processors. Larger units are available that can record the ambient temperature of the hold and also have wired probes (up to 20 feet in length) that can be inserted into individual fish to record internal temperatures. These units are generally wall mount units that can be downloaded to a computer by a portable hand-held data transfer device or removed and downloaded at port or in the wheelhouse. These devices can be used either on-deck, to provide information on initial cooling, and/or in the hold to provide longer-term time-temperature monitoring.

Currently, no time-temperature monitoring is required and very little is provided by the albacore fishermen to the rest of the industry. Some individuals may be utilizing these technologies to provide more quality assurance to their customers but these cases are rare.

On-board handling and time-temp monitoring options:

Albacore fishermen are required to provide the National Marine Fishery Service with a completed albacore logbook. This logbook only provides limited information on general catch location and number of fish and does not provide any useful information for quality assurance and on-board handling procedures.

In order to provide additional information to fish buyers about quality handling procedures conducted on the vessels it is recommended that electronic data capture or written forms be utilized which identifies:

- Date and time of capture
- Average time fish spent on deck before being placed into storage (record of time caught and when placed into storage will give time of deck)
- On-deck cooling technique (if any)
- Time and place fish was removed from storage

Because of the nature of the fishery it may be difficult to record each fish. Often fish are hooked in schools and fish may be landed at a rate of one per minute or faster. Therefore, it is suggested that the data reflect an average over a 4 hour period. In addition, a record of ambient air temperature would be beneficial to buyers especially when time on deck exceeds 4 hours before storage. Histamine forming fish like albacore are addressed specifically by HACCP guidelines, which state that rapid chilling of fish immediately after death is the most important element in any strategy for preventing the formation of scombrototoxin, especially for fish that are exposed to warmer waters or air, and for large tuna that generate heat in the tissues of the fish following death. They recommend that fish which are not eviscerated on-board and are less than 20 pounds, should be placed in ice or in refrigerated seawater or brine at 40°F (4.4°C) or less within 12 hours of death, or placed in refrigerated seawater or brine at 50°F (10°C) or less within 9 hours of death. Fish greater than 20 pounds should be chilled to an internal temperature of 50°F (10°C) or less within 6 hours of death. This will prevent the rapid formation of the enzyme histidine decarboxylase. Once this enzyme is formed, control of the hazard is unlikely. HACCP and Food and Drug Administration guidelines suggest that fish that do not meet these guidelines or lack appropriate documentation be tested for histamine prior to processing and consumption (1 fish per ton if over 20 pound average and 2 fish per ton if below). These procedures are time-

consuming and expensive and may be alleviated by proper on-board documentation of handling procedures and time/temp monitoring.