Technology Tweaks & Quality Controls for Alaska Shrimpers

United States Department of Agriculture
Trade Adjustment Assistance Program
Southeast Alaska Shrimp

Greg Fisk, SeaFisk Consulting & Management LLC for Alaska Sea Grant Marine Advisory Program
Technology & Quality Control
what we’ll look at…

Industrial technology & product processing/handling evolve to meet management & market requirements.

Fishing gear, onboard handling, freezing technology, packaging & general best management practices for shrimp vessels…and an overview of shoreside processing of coldwater shrimp

“Best practices are essential for Alaska fishermen to regain and maintain business competitiveness”
Let’s look at technical tweaks first.

Then we’ll move to quality issues
Pot gear

For pot shrimpers, gear is pretty clearly defined: 100 large pots / 140 small pots

Generally accepted that large pots are “fishier” – greater volume promotes higher catches...but may take more small prawns

Small pots are individually easier to handle, can be rigged to cover more ground, etc.

Typical fishing trade-off...no right answer

An Auto-Coiler might help. A Juneau guy is making a nice, compact unit called the “Extra Deckhand” http://www.extradockhand.com/
Are there ways improve pots?

Regulations limit options – purpose is to standardize the gear

Better “bios”? – dissolving zinc releases work, but are they any better than cotton?

Partial covers? – catchier but not allowed

Corrosion resistant stainless steel & coated frames to extend working life?
Beam trawl gear

Much more complicated than pots

Beam vs. otter trawls

D – rig beam vs. Plumb staff beam

Multiple options on the net itself
Trawl gear - beam vs. otter trawls

BOF eliminated six Southeast otter trawl licenses in 1997...really a political decision

Beam trawls are not inherently more eco-friendly & otter trawls offer operating advantages...something to think about for the future

But beam trawls do have their own advantages...and disadvantages
Traditional SEA beam trawls

Plus side...

- Proven in decades of use
- Heavy wood beam – max practical size about 60’
- Simple net construction – no codend, brailers for emptying net
- Large mesh “weed gear” at net opening saves gear / effective bycatch excluder
Traditional SEA beam trawls

Down side...

• Regulations & traditions limit efficiency
• Not easy to fish deep – limiting fishable grounds
• Design limits towing speeds
• Fair weather gear - high towing point, side recovery create potentially dangerous stability & handling issues
Beam trawl design is not static

Fishermen have adopted important otter trawl features – standard net shapes / codends / etc.

Modern materials like aluminum & UHMW shoes make gear easier to use

Plumb staff is an alternate to D-rig beam
Plumb staff trawl gear

- Common in B.C.
- Much lighter rig

Note long aluminum beam in rigging

- Smaller boats can fish a beam greater than the boat length
- Gillnet gear drum can be used to haul & stow the trawl warp

Dickson's Trawls & Netting Supplies / Smart Net Systems Ltd.

50’ high rise beam trawl rig being tested in flume tank, St. John’s, Newfoundland
Where’s the drag in a dragger?

Power use by the various parts of a conventional otter trawl set-up:

- Warps & Bridles: 11%
- Doors: 25%
- Footrope: 8%
- Net: 50%+
- Vessel Hull: 6%

94% to overcome trawl drag

D. Rihan, Bord Iascaigh Mhara (Irish Sea Fisheries Board), 2007

No similar work on Alaska beam trawl gear. Overall power needs are much less, but, gear drag almost certainly still accounts for 90% of fuel use while fishing.
Hydrodynamic beams & Sumwing trawl gear

Dutch have had good success reducing drag with shaped rather than round profile beams.

In 2007, they ran trials with the “sumwing” - a suspended wing with nets. Much lighter than conventional beam trawl & less resistant because no heavy D-ring shoes are needed.
Net drag

Duplex trawls can reduce total webbing by 40% to 50% compared to a conventional single otter trawl net.

Knotless twine has 15% less drag, and can save as much as 12% on fuel depending on towing speed … but is not as easy to repair.

The same principles can be applied to a beam trawl.

D. Rihan, Bord Iascaigh Mhara (Irish Sea Fisheries Board), 2007
Double rigging...

- Double rig gives same web reduction as a duplex
- Two 30’ beams have same swept area as a 60’ beam
- Safer & easier to fish on regular bottom

May be tricky to fish on side hills, but fishermen should make that call depending on conditions. Double rigs not allowed under current regulations. Why?
Bycatch & Selectivity

Nordmore bycatch reduction grates are of little use given typical slow towing speeds.

The large mesh panels used at the front of bean trawls are very effective excluders.

But a size sorting grate could be big help.
Tech Ideas...to save fuel

Remember the fuel price panic in 2008 when crude hit $140+ / barrel?

Good for Alaska’s budget, but bad for yours

Well, oil is back up to $90+ and climbing...

Being fuel-wise is good for shrimpers’ bottom lines... here are a few ideas
Interested in fuel issues? Here are some things you might find of interest:

**Save Money on Boat Fuel: Brochure**
Author: Terry Johnson
Pub. no.: SG-ED-62 / Year: 2008 / Price: Out of stock; available online only

**Does Diesel Have a Future in the Fishing Industry?**
Author: Greg Fisk
Pub. no.: ASG-52 / Year: 2010 / No. pages: 8
Price: Free (PDF download)
Tech Ideas

Aerofoil rudders offer better fuel economy through lower drag, better steering & maneuverability.

You don’t need a fancy “high lift” flap design. Simply fairing your existing flat rudder will do.

A good winter DIY job
Tech Ideas

Kort nozzles duct water flow around the prop ... up to 25% more thrust for the same power... or the same thrust for 25% less fuel!

Conventional draggers should all have a Kort nozzles...but their utility for shrimp beam trawlers is questionable. Why?

Small, simple gear & low towing speeds minimize power requirements...and capital investment is substantial. But, if your boat lacks power, you want to fish deeper, or tow faster...a nozzle might help.
Tech Ideas

Fuel Flow Meter & Stack Pyrometer

Inexpensive instrumentation to give you real-time fuel consumption and engine performance data.

A pyrometer can also give early warning of engine problems...could save you big $$$.
Tech Ideas

Clean, light, efficient Tier III diesel main engines...if you are due for major repairs a new engine could pay off in future fuel savings

The State now has excellent, low cost loans for re-powering

If you’re thinking of a new engine, assess your power needs carefully. Many boats built or re-powered in the ’80s & ’90s are over-powered
Tech Ideas

Bulbous bows improve fuel efficiency & sea keeping… most effective on larger displacement hulls

Platypus Marine, Port Angeles, WA
– bulbous bow retrofit on 58’ Delta

But if you are not running long distances at 80% or more of your maximum speed, a bulb is probably not worth the retrofit cost.
Tech Ideas…Onboard Freezing

- Flash freezing systems
- Holdkeeping systems,
- Insulation Requirements, and
- Auxiliary Power and Water Needs

*Freezing is the No. 1 value add technique for shrimpers*
Flash freezing...

To effectively freeze shrimp & preserve value you need to freeze them fast...

Slow freezing creates various quality problems

Just having a freezer hold – no matter how cold – isn’t enough

You need an effective flash freezing system
What are your choices...

For typical Alaska shrimp fishing vessels operating in Southeast there are basically two choices:

- Blast freezing, or
- Single contact plate freezing

Brine freezing is the norm in many warm water shrimp fisheries, but is not generally accepted practice for spot prawns or other coldwater species.
Blast freezers

- Blast freezers work by blowing air over the evaporator coils of the freezer unit ...thus removing heat from the air.
- The frigid air blast then circulates around the product...again removing heat.
- The process continues until the desired product temperature is achieved.
Early efforts...

Enterprising fishermen have put together blast freezer systems with used components from freezer trucks and reefer containers.

Many of these systems worked fine...some didn’t. Fortunately, things are a lot easier now...
Purpose built units…

Now fishermen can buy blast freezing units built for marine use, and designed specifically for small vessel operations.

This hatch mounted unit does double duty as an initial flash freezer and holdkeeping system.
For somewhat larger vessels...

On boats with sufficient deck space, a blast freeze cell can be mounted on deck, as on this albacore boat.

A separate system is installed for the freezer hold.

Typically, the compressors and other refrigeration machinery will be in the engine room.
Blast freezing concerns

Blast freeze systems are simple & reliable, but…

Blast freezing can cause more dehydration loss than other systems. This varies by system and how they are run. Boxing product before freezing helps, but doesn’t eliminate this problem.

Blast freezer evaporators tend to get heavily frosted, and require defrost cycles.
Materials available from MAP
UofA Seagrant Marine Advisory Program

For more info about onboard freezing, check out http://seagrant.uaf.edu/map/seafood/

You’ll find the following presentations:

Regulations Governing Freezing Onboard [pdf presentation;232K]

Small Vessel Freezing Systems [pdf presentation;988K]

What Happens to Fish as it Freezes [pdf presentation;484K]
Plate Freezers

Double contact plate freezers, by well know companies like Sabroe, Kvaerner & Jackstone, are the gold standard for onboard freezing products like boxed prawns. But, their size, weight, complexity & cost rule them out for small vessel applications.
Single contact plate freezers…

don’t have complex hydraulics and moving plates like double contact systems. They’re not quite as efficient, but are simple, robust & relatively inexpensive.

They use extruded aluminum plates finned for efficiency.
Onboard units…

Racks of freezer plates are often packaged in insulated, self-contained cabinets. They just need cooling water & electricity.

All the refrigeration equipment is conveniently packaged beneath the freezing enclosure.
Small systems…

The full-sized freezer cabinets are too big for deck mounting on many boats. Smaller boat solutions include:

- Hatch mounted units with remote located machinery
- Self-contained chest freezers with integral quick freezing shelves
Hold keeping systems...

The same extruded aluminum plates used in the freezer cabinet can be used in your hold.

Plates are screwed to mounting blocks on the overhead.

Refrigerant is piped thru the bulkhead from the engine room.
Other systems...

Overhead coils – loops of pipe – have been used successfully for years. Finned coils add some efficiency at a cost in upfront cash and durability.

A small blower unit will also work. It’s the same technology as a blast freezer – a fan circulates air over the evaporator and through the hold.
Hold Insulation

Unfortunately, odds are that you don’t have enough insulation. Few fishing boats were built with freezing in mind.

There’s no absolute, but a minimum of 4” of foam – top, bottom & sides - is a decent rule of thumb.

Good insulation assures no “hot spots” and keeps your system from working too hard.
Hold Insulation

If your hold will see double duty in non-freezing applications, probably the best set-up is fiberglass over the foam. It’s durable and easy to clean.

You’ll also need to ensure that there are circulation channels on the side walls and floor.

Building in freezing capability definitely impacts hold volume.
Power & Water

Any serious system will require an AC generator for 110v or 220v power.

Let’s say you have a freezer cabinet with a 10 hp compressor and a hold system with a 7.5 hp compressor.

1 hp = about $\frac{3}{4}$ kW, so you’ll need 13+ kW just to run those units simultaneously.
Genset sizing…

But you’ll need more than that for start-up – even with “soft start” motors and a generator designed for motor starting.

You’ll have other demands on your generator. In this situation, a 20 kW genset would probably be adequate…But work closely with your refrigeration specialist to carefully assess total demand.
Water system

You’ll likely need a seawater system to provide cooling to the refrigeration condenser system.*

Volume demands aren’t huge, but you need a reliable, continuous duty pump…and it’s a good idea to carry a spare.

*Air cooled systems are possible, but have noisy fans, take up a lot of space, & are not very reliable on boats.
Prawn quality issues…

When spot prawns come out of the water they are “as good as it gets” in the world of seafood…That’s “intrinsic quality”

What happens to them afterward – “extrinsic quality” - is up to you
Live prawns…

Exporting live prawns from Alaska is tough

- Far from markets
- Dead loss often wipes out higher price

But some prawners manage it, and others sell live on local markets for a premium price

- Keep your live tank chilled (mid-30°) to slow metabolism & limit mortality
- Never circulate harbor water through your live tank
Fresh Prawns…

Whether retailing fresh at dockside or sending them to a processor…

Tail your prawns quickly…enzymes in the head cause rapid deterioration in whole fresh prawns

Putting prawns directly on ice can leach color…better to put them in a basket or bucket buried in the ice
Whole Frozen Prawns…

Should be still “kicking” in the box when they go into the freezer (Standard box / 1 kg)

Keep boxes & packing materials spotlessly clean / a top liner helps reduce frosting

Use dip chemicals according to buyer’s spec…many mixes render your product “export only”

Size Grade & Finger Pack
Carefully & To Specification!
Product description – Major Japanese Importer

Product description from Schooner Co Ltd - Japan’s biggest importer of cold water shrimp

“We import 6000MT of shrimp from Greenland, Canada and Russia. Our brand name means the No.1 quality in Japan for many years.”

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<th>Commodity</th>
<th>Cold Water Shrimp</th>
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<tr>
<td>Scientific Name</td>
<td>Pandalus borealis</td>
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<td></td>
<td>Cooked Frozen ((5kg X 1)</td>
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<td>Remarks</td>
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Frozen Prawn Tails…

Fresher the better

Carefully Size Grade & Flash Freeze ASAP

Make sure the tails are undamaged and don’t have legs or body bits still attached

Good box or study bag – a box with liner is best

A good, simple glaze (water & a bit of corn syrup works great) after freezing really extends shelf life
Trawl shrimp quality issues…

Bycatch – heavy bycatch can crush shrimp / all bycatch must be rigorously sorted out

“Pinheads” – excessively small shrimp are useless & a big sorting problem / stay out of juvenile rearing areas

Cleanliness – mud & debris are definite “no no’s”
Whole frozen shrimp...

Same principles as with whole frozen spot prawns

- Should be the first shrimp processed & into the freezer ASAP (Standard box / 1 kg)
- Keep boxes & packing materials spotless
- Use dip chemicals according to buyer’s spec

You can random pack. Only the largest sidestripes may need to be finger packed
Whole cooked…

You’ll need a full processor permit from DEC for this product form (under 5,000 lbs / day = $795)

Proper cooking time is tricky…over cooking results in rubbery, tasteless product / under cooked shrimp are hard for consumer to peel

IQF standard…cooking & IQF freezing difficult on a small vessel / Industry standard box is 5 kg / 11 lbs
Industrial...

This is the term for shrimp destined for peeling... just the smallest sizes / the larger grades should go to more valuable products

It can be your last production from any given tow

Block freeze in large bags or boxes