Pot Fishing and Research
Western USA

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Three Main Subjects

Pot fisheries and pot development
Basic behavioral information/model
Behavior studies
Sablefish pot development
(late 60s early 70s)

Making Fish Pots from Alaska Crab Pots

Lead to: Smaller Pots
(foldable, stackable, etc)
Small Pots are Longlined

Figure 1. A pictorial view of a string of halibut trapping gear.
Alaska Cod Pot

Recording triggers
Al Stoner’s Bait Capture Papers


Baited fishing gear behavior model

<table>
<thead>
<tr>
<th>Environmental variable</th>
<th>Primary mechanisms</th>
<th>Behavioural patterns</th>
<th>Responses to baited gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature, Flow, Current, Wind</td>
<td>Metabolic processes</td>
<td>Activity</td>
<td>Detect, Active space</td>
</tr>
<tr>
<td>Light, Turbidity</td>
<td>Sensory limitations</td>
<td>Feeding capability</td>
<td>Search, Locate</td>
</tr>
<tr>
<td>Bottom type, Composition, Competitors</td>
<td>Social interactions</td>
<td>Feeding motivation</td>
<td>Attack, Consume</td>
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</tbody>
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Catchability
Observing Fish Near Pot with Sonar and Camera

Tests and environmental conditions

Observations
Within 1 m of a 1 x 2 m fish pot (and baited hooks)
5 – 10 m away from (downstream) bait

Tools
ICCD camera with infrared illumination
DIDSON sonar ‘camera’

Environment
366 m deep
current 2 – 15 cm/sec
Temperature 5.5 – 6.5 degrees C
Light < 10⁻⁷ micromoles-photons m⁻¹ s⁻¹
Observing Fish Near Pot with Sonar and Camera

Number of Fish by Time
Highlights of results from pot/hook study

Of 2000 + 5000 entries of sablefish into the observed field (sonar) 19 sablefish were caught

Restricted view of video camera can give a biased impression of fish abundance and behavior

– particularly dependant on relation of observed side to current direction

‘Rotating’ Sonar Mount
Range 5-10 m
Launch of Rotating Sonar Mount

Sonar Image
Sonar Image
With background subtraction

Tracks (Set 3)
Initial highlights from ‘approach’ study

Fish commonly 5 – 10 m from bait

Much fish motion is circulation around the bait, not just to and from the bait

Ways Forward

Improved pots

Improve proportion entering

Active tunnels

Behavioral tuning

Volume / Number optimization

Bait optimization
Ways Forward –
Alternative combinations/gear

Baited tangle gear (short gill nets)
  Angles of crossing

Bait combined with active gear
  Time to highest concentration
  Local bottom disturbance as bait
It isn’t the Pot – It’s the Cod

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East Coast Pots

Lobster *Homarus americanus*,
scup *Stenotomus chrysops*, Black Sea Bass *Centropristis striata*,
Channeled whelk *Busycon canaliculatum*, Red Crabs

Flounders: David Beutel; Pingguo He and Kelo Pinkham: Not much luck; low densities

Gadoids: P. He and Proctor Wells: Not much luck; low densities. Pot modified from CSAR design

Cliff Goudey and Mathew Thompson: Round pot; no luck
CSAR Pots

Frame: Either coated wire (183 cm by 183 cm by 106 cm), 16 mm rigid steel frame, or collapsible steel (183 cm by 183 cm by 102 cm).

Top: 30 M of 10 cm diamond PE with float.

Entrances (2): Rectangular opening, 41-cm ring with SS one-way triggers spaced ~5 cm apart. 20 M of 2.5 in nylon

Bait: Squid, salted herring, clam, scallop, other using buckets, cages, and skivers.

Results

348 cod in 137 soaks; 2.5 cod/soak; first ever! Maximum of 13

Length range = 32-75 cm; average = 47 cm

Construction type did not matter

Location mattered

Cod in pots had empty stomachs, and were not spawning.

Pot alterations had no impact

Zero mortalities and many recaptures
Results

Atlantic Cod

Cumulative frequency

Length (cm)

P95, N = 90
114 mm, N = 102
127 mm, N = 147
140 mm, N = 188
152 mm, N = 79
165 mm, N = 199
178 mm, N = 168
203 mm, N = 71
216 mm, N = 56
229 mm, N = 46

Inside the Box
Nip at String

Loose Bait Frenzy plus Penetration
Entrance Attempt?

Conclusions and Directions

Pots can catch cod in two seasons; changing entrances did not improve catches.

Focus on hunger and spawning relationships.

Compare pots to longlines – although same season.

Alter bait contrast or induce flashing - feeding “frenzy” necessary?

Or is it just density dependent?
Feasibility of a Directed Atlantic Haddock Pot Fishery in the Gulf of Maine

Ken La Valley,
University of New Hampshire and NH Sea Grant
Nesmith Hall, Durham, NH 03824
and
Kelo Pinkham, ME Fishermen
Bill Lee, MA Fishermen

Why a Haddock Pot Fishery?

- recent increase in abundance of the Gulf of Maine haddock,
- recent unexpectedly low projection of cod abundance, and
- inability of the current means of harvest to access these fish without the taking of excessive amounts of bycatch (species of greatest concern being Cod).
Project Objectives

- Evaluate three trap designs for their ability to catch fish in general, and target Haddock.

- Evaluate fish behavior in and around fish traps using underwater video.

- Evaluate three several baits for their ability to catch fish in general, and target Haddock.
Trap Designs

Pacific Cod Pot
- Offset Entrance Head Trap
- 48" Mesh Balloon
- 9" x 18" Funnel Eye w/ Triggers
- Collapsible

Alaskan Crab Pot
- In-line Entrance Head Trap
- 9" x 18" Funnel Eye
- Triggers
- Collapsible

Trap Designs Cont.

Norwegian 2-Chamber Pot
- two 30" chambers
- 15" Mesh Balloon
- 20" Entrance w/o Triggers
- Collapsible

* Photograph courtesy of Bill Lee
Evaluated Bait Types

- Artificial haddock bait (NORBAIT)
- Surf Clam - shucked, bait quality
- Herring - bait quality

Norbait™ is manufactured by restructuring waste fish and fish offal from processing industry and mixed with gelling agents, binders and other attractants. The mixture is then extruded into a fiber mesh tube for a continuous "sausage".

Road Blocks

- Field trials were scheduled for spring and summer 2006 during high abundance of inshore haddock.
- NMFS EFP permitting process delayed experiments until October.
- Charter vessels and gill net fishermen reported low haddock catch rates. October is the tail end of haddock movement out of the inshore area.
- We decided to begin trials to evaluate design construction and camera systems.
Initial Results

Conducted (5) Experimental hauls with 24 hour soak times.

Initial results appear to indicate the Norway design to be most effective and the whole clam bait to perform the best.

Off-Set Entrance Pacific Cod Pot Design

* Photograph courtesy of Bill Lee
What Can We Say?

• Each pot design successfully caught fish.
• Seasonal correlation between fish abundance and trap CPUE probably accounted for low catch.
• The Norway trap w/ surf clam bait appeared to be the most successful combination.
• Field trials are scheduled to begin in April/May 2007 when high haddock abundance is observed.

Potential Modifications

• Evaluate a “Floated” two-chamber design to eliminate lobster/crab bycatch, and allow free rotation with current which will maintain optimum bait plume directionality.

• Add triggers to the two-chamber design?
Fish Potting in Asia and Some Recent Works in Japan

Philippines
Malaysia
UAE
Thailand (A. Boutson)
Indonesia (J. Haluan)
Korea (An Young-II)
Taiwan
Okinawa

T. ARIMOTO (Tokyo Univ. of Mar. Sci. & Tech.)

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Fish pot in Asia
Fish Pot in Philippines

Fish Pot in Malaysia
Fish Pot in U.A.E
Pot in Thailand
Bycatch and Its Reduction from Blue Swimming Crab Pot Fishery in Thailand

By

BOUTSON Anukorn, MAHASAWASDE Chaichan, MAHASAWAS Songsri and ARIMOTO Takafumi

Collapsible blue swimming crab pot
A set of single crab pot

- **Body**
  - Iron structured
  - Box shape
  - PE 38 mm
  - Hook

- **Float line**
  - PP rope
  - Length 2-3 times of water depth
  - Small lead (sinker)

- **Float**
  - Plastic/Foam

Collapsible crab pot (single pot) operation

- 200-300 pots
- 6-8 m boat length
- One man operation
- 12-24 hr Soaking time
Commercial crab pot boat

- 2,000—5,000 Pots/boat
- Hauling machine

Escaping from the lower side panel position (VDO)
Fish Pot in Indonesia
Pot in Korea

Fish Pot in Taiwan

from Fishing Gear and Methods by Prof. Chou
Fishing Activities in Okinawa Coral Reef

- Angling
- Hook and line
- Longline
- Trolling
- Net Fishing
- Set-net
- Drive-in net
- Gill net
- Others
- Fish Pot
- Spear fishing for lobster and turtle
- Diving collection for octopus, cuttlefish, shells and urchins, and sea algae

Fishing Grounds for Fish Pot and Set-net in Coral Lagoon

- 4 Sets
- 3 Sets
- 7 Pots
- 10 Pots
- 2 Sets
- 13 Pots
- 2 Sets
- 2 Sets
Fish Pot in Coral Reef Area

Operation Process with Underwater Diving Works
Pot, Trap, Basket, Tube, ……

- Bamboo / wooden frame
- Chicken cage
- Longline setting
- How many……?

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Pot Fishing in Japan

- Annual Catch on 1980
  - Snow crabs 61%
  - Shrimp 6%
  - Conch 17%
  - Octopus 2%
  - Cuttlefish 2%
  - Sea Urchin 1%
  - Hairy crab 3%
  - Other crabs 7%

- 85,000 ton
- 0.3 Billion $
Behavior of Puffer *Lagosephalus* and the Fishing Mechanism of the Pot Trap

Mamoru Hirayama, Shigeru Fuwa, Munehiko Ishizaki, and Takehiko Imai


Fig. 5. Behavior sequence chart of puffer to the trap. Bracketed numbers shows the result of tank experiments and make it possible to show to the trap.

Fundamental studies on the hydrodynamic resistance of small pot traps.

Fisheries Science 70 (6), 952-959. 2004

BUDIMAN J, FUWA S. & EBATA K.

(a) Netted semi-cylinder; (b) Wire semi-cylinder; (c) Heart; (d) Box; and (e) Cylinder shape.
Schematic of the experimental apparatus used to measure hydrodynamic resistance.

Flow: 0.1 - 0.5 m/s

Re = 1.0x10^3 - 6.7x10^3
Behavioral responses of arabesque greenling to trap entrance design.

*Fisheries Science* 72 (4), 821-828. 2006

LI Yong, YAMAMOTO K., HIRAISHI T., NASHIMOTO K. & YOSHINO H.

Arabesque greenling *Pleurogrammus azonus*

(a) Commercial trap dimensions, and (b) simulated trap entrance model
(a) Fish swims towards the model, (b) fish approaches the model, (c) fish is passing, (d) fish has passed through the trap entrance.
What can we learn from …?

• Comparison from others
  – Gill net, longline, hand line, … trawl,…?
• Comparison from other traps
  – crustaceans
• Possibility for trawl ban alternatives…?
  – Eco-friendly aspects
  – Size / species selectivity
• Possibility for increasing efficiency

Research Topics

• Enter / Escape
• Inter/Intra-specific Behaviour inside pot
• Accumulation and Soaking Time
• Density related aspects

• Improving efficiency
  – Larger space
  – Long-line system with collapsible/piling-up
  – Entrance / Funnel design
  – Bait