Fish Meals from Fish Byproducts

High Quality Protein and Oil

Approximate Composition
- Protein 65-70%
- Fat 8-12%
- Ash 9-17%
- Water 6-10%

Pollock Meal
Commercial Fish Meal
Protein Hydrolysates
Protein Hydrolysate Processing

- Hydrolysate technology can offer smaller processors a cost effective method to handle their seafood processing byproducts.

- Possible to produce high quality oils and protein feed and fertilizer products
Protein Hydrolysis - Enzymatic Process

Protein hydrolysis with endo-protease and exo-peptidase

Endo-protease

Protein → Peptides

Exo-peptidase

Peptides → Peptides and free amino acids
Experimental Hydrolysate Production in Kodiak
Fish Oil
Fish Meal and Fish Oil Processing
Fish Oil Products

- Used as Food or Feed Ingredient
- Sources of Long Chain Omega-3 Fatty Acids
Oil from Aquaculture Raised Catfish

- Catfish oil can be extracted for viscera and used as food and feed ingredients
- Oleic and linoleic acids accounted for ~ 86% of unsaturated fatty acids (different from marine oils)
Fish Bone

Fish bone is combination of minerals and protein

Mineral supplements and premixes
Fish Bone Meal Products
Dried Fish Bone Snacks
Can We Add Value to Parts, Pieces, and Organs?
# Components of Alaska Fish Processing Waste (Metric Tons)

<table>
<thead>
<tr>
<th>Components</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heads</td>
<td>384,468</td>
</tr>
<tr>
<td>Frames</td>
<td>385,260</td>
</tr>
<tr>
<td>Viscera</td>
<td>423,818</td>
</tr>
<tr>
<td>Skins</td>
<td>107,327</td>
</tr>
<tr>
<td>Total</td>
<td>1,309,212</td>
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</tbody>
</table>
Aquaculture Catfish Byproducts

- Total Byproduct about 55%
- ~ 150,000 metric tones of raw catfish byproduct or 30,000 metric tones dry per year
- Heads, Frames, Skin, and Viscera
Fish Frames

Uses
- Protein Mince
- Fish Meal and Oil
- Protein Hydrolysate
- Bone and Bone Meal
Fish Heads

Uses

- Oil from salmon heads & others
- Mince
- Proteins-collagens, CS
- Organs – eye and brain
- Protein meals and hydrolysates
- Gills
- Food – dried and fresh heads
Fish Skin

Uses

- Gelatin
  - Food ingredient
  - Feed binding agent
  - Edible films
- Collagen
- Food product
- Leathers
- Others
Fish Skin Leathers
Fish Viscera

Uses

• Feed Ingredient
  • Meals
  • Oils
• Source of organs
• Biochemicals, enzymes etc
• Attractants and palatinates
• Others
Protein Meals from Livers, Roe and Testes

- Extract specific protein mixtures from processing byproducts with superior physical properties

- Feed and food ingredients with unique chemical and functional properties
Viscera Parts of Interest

Viscera organs include:

- Gonads – milt and roe
- Livers
- Stomachs
- Gall bladder
- Heart
- Others
Milt (Male Reproduction)

**Uses**
- Protein powder
  - Human foods
  - Animal feeds
- Unique proteins
- Nucleic acid
- Lipids
Fish Stomach Products (Dried)
Fish Livers

Uses

- Oils
  - Vitamins
- Protein powders
  - Human foods
  - Animal feed ingredients
- Pâte
- Protein meals
- Others
Cod Liver Products
Pet Food Products
Others Fish Byproducts

- Stick water and solubles
- Blood
- Swim bladders
- Gill
- Eye
- Neural tissues
- Snouts

Dried stick water
Biochemicals from Byproducts

Pigments - Phospholipids
Vitamins A & D
Chitin - Shrimp & Crab Shell
Minerals – Bone & Shell
Amino Acids, Peptides, Proteins & Enzymes
Industrial Uses

Biodegradable Packing Materials
Cosmetics Ingredients (Fish Oil)
Decorative Items (Fish Scales)
Gelatin Glues & Films
Fuels from Fish Oils

Boiler Fuel from Fish Oils
Bio-diesel from Fish Oils
Bio-gas from Processing Wastes
Fish Oil to Biodiesel

- **FISH OIL**: 18 tons/day
- **METHANOL**: 3.5 tons/day
- **KOH/NaOH**: 0.07-1.5 tons/day
- **BIODIESEL**: 13 tons/day
- **GLYCEROL**: 3.5 tons/day
- **WASTE WATER**: 35 m³
Fertilizers and Soil Conditioners

Standard Fish Fertilizers
  Fish Meals
  Hydrolysates
Organic Fish Fertilizers
  Compost
  Bone Chips and Meals
Fertilizer Products

Ocean Harvest

Organic

Fish Fertilizer
2-3-0

Made for Houseplants, Lawn/Garden, Flower, Vegetable, Fruit, Trees/Shrubs

www.naturalinsectcontrol.com
Fish Silage

Handling Fishery Wastes and By-products
Fish Liquifaction

U.S. Departments of Food Science and Meat and Animal Science
Aqua-ponics
Organic Fish Fertilizers

Wild fish are not certified organic food by National Organic Standards Board

Wild fish fertilizer can be used to produce organic crops
Product Applications:

Ingredients for Aquaculture & Other Uses

- **Protein Meals & Powders**
  Dried fish meals & protein powders from heads, viscera, frames, roe, milt, and skin

- **Protein Hydrolysates**
  From salmon and pollock By-products

- **Salmon & Pollock Oils**
  Oils from salmon heads and pollock By-products including livers are excellent sources of long chain omega-3 fatty acids

- **Bone Meals & Mineral Supplements**
  Fish bones have minerals used to fortify animal feeds and other uses

- **Gelatins**
  Films made from gelatin extracted from cold-water marine fish skins have unique properties

- **Others**
Further Readings:
Fish Byproduct Symposia in 2002 and 2009


Thank You