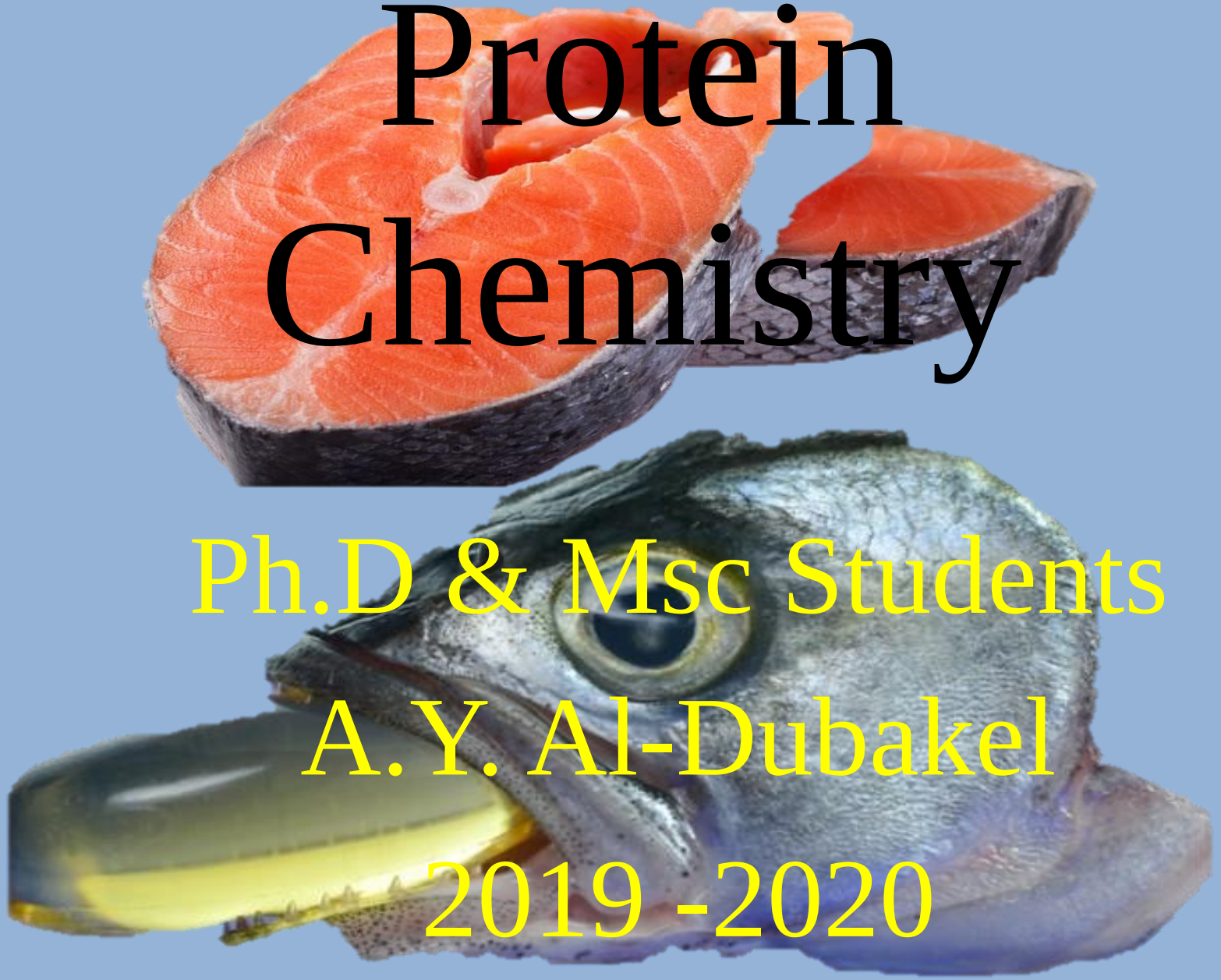
Protein Chemistry



Ph.D & Msc Students

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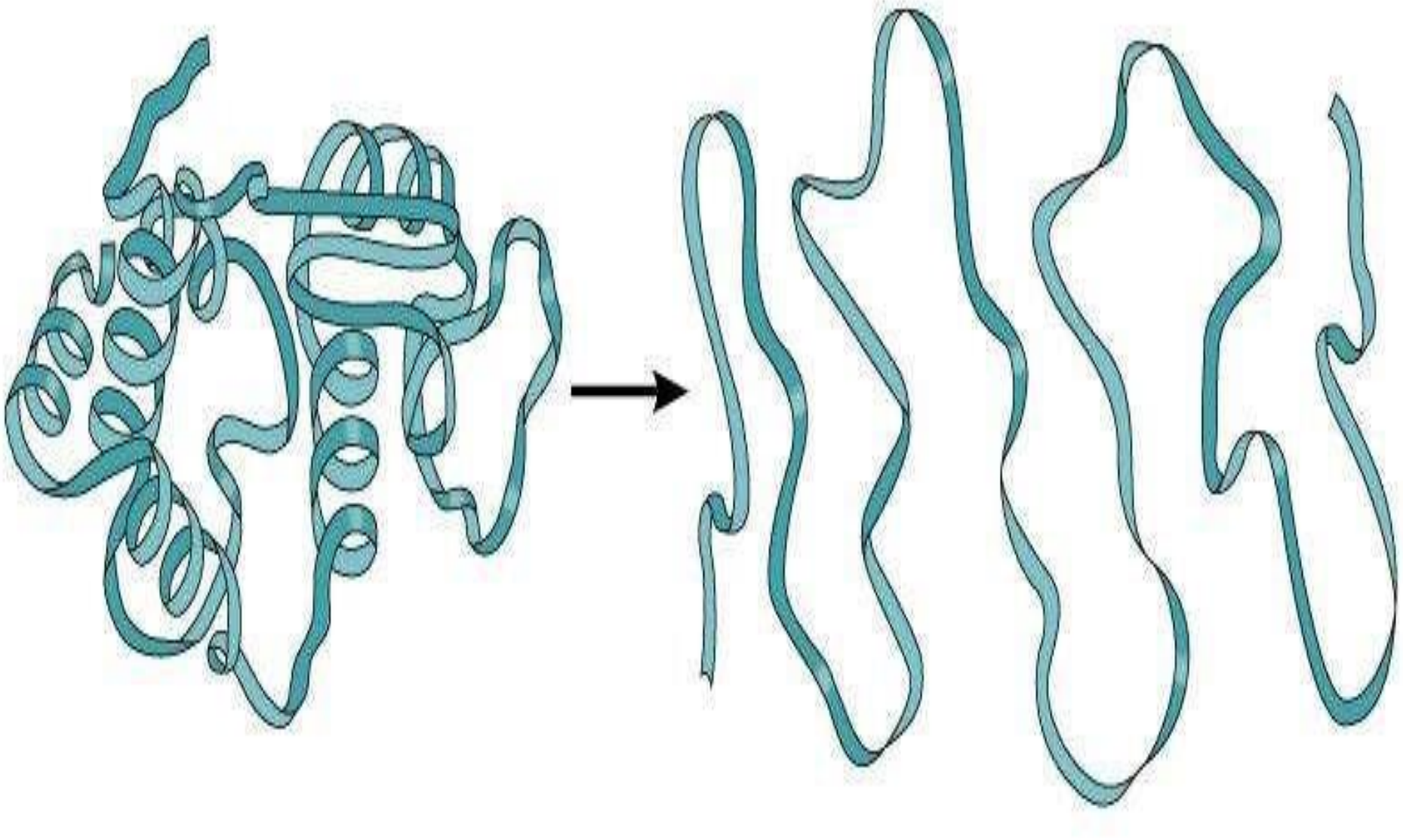
Denaturation of proteins-

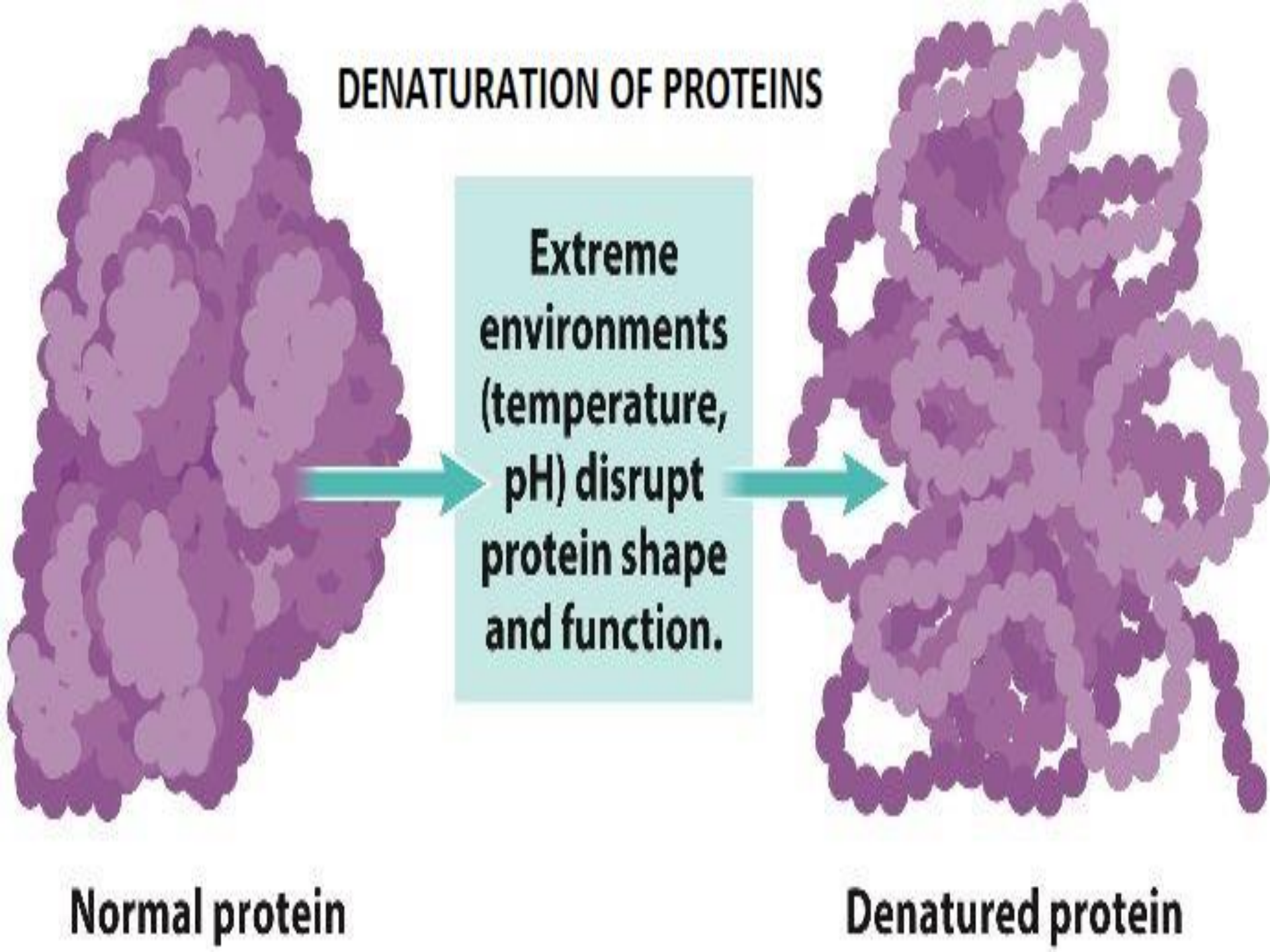
- **Denaturation** -is a process in which proteins or nucleic acids lose the quaternary structure, tertiary structure and secondary structure.
- Which is present in their native state, by application of some external stress or compound such as a strong acid or base, a concentrated inorganic salt, an organic solvent (e.g., alcohol or chloroform), radiation or heat.
- exposure of hydrophobic groups.

- If proteins in a living cell are denatured, this results in disruption of cell activity and possibly cell death.
- Denatured proteins can exhibit a wide range of characteristics, from conformational change and loss of solubility to aggregation due to the Denaturation of fish proteins during different procsessing methods (freezing, drying) due to change in temperature, pH, and acid or base concentration etc.



Active (functional) proteins

Denatured proteins


DENATURATION OF PROTEINS
Extreme environments (temperature, pH) disrupt protein shape and function.
Normal protein
Denatured protein

Change in the quality of protein

- Protein goes through certain chemical changes when it is heated and cooked. When the proteins in food are heated, they coagulate, which means they become firm.
- When exposed to hot temperatures, the protein shrinks and losses moisture. This usually occurs at temperatures between 160 and 185°F.
- When meat sources of protein are cooked slowly, any connective tissues are likely to dissolve. Heat does not destroy the protein in food, though it might reduce the overall content slightly.

Effect of pH and salt on protein quality-

- During post mortem changes,there is formation of acids, so at low pH most of the main muscle proteins are at their isoelectric point and the meat fails to attract and hold water, so it releases drip. This phenomenon is known as "drip loss."
- Salt (NaCl) is highly water soluble. The functions that salt provides in meat mixtures are mainly determined by the dissociated ions Na^+ and Cl^-. When salt is mixed with comminuted meat the Cl^- ion increases the negative charge of the proteins. The adsorption of Cl^- ions onto the positively charged groups of myosin results in a shift in its isoelectric point to a lower pH, also causing a weakening of the interaction between oppositely charged groups at a pH greater than the isoelectric point.

- In the presence of salt, part of the insoluble myosin passes into the liquid phase and dissolves, increasing meat swelling and water holding capacity in its dissociated ionized form (H^+ OH.($^-$
- Salt-solubilized myofibrillar proteins form a sticky exudate on the surface of the meat pieces, which binds them together after cooking. This layer forms a matrix of heat-coagulated protein which entraps free water. The increased water-holding capacity of salt-treated meat gives it a higher cooking yield, and greater tenderness and juiciness when the product is consumed

Protein shape determines function

- Amino acid order determines the shape (conformation) of a protein
- Conformation determines function
- Function depends on its ability to recognize and bind a molecule

Amino acids → conformation → function → binding

Protein bindingexamples

- **Antibodies** bind to particular foreign substances that fit their binding sites.
- **Enzymes** recognize and bind to specific substrates, facilitating a chemical reaction.
- **Neurotransmitters** pass signals from one cell to another by binding to receptor sites on proteins in the receiving cell.

Color of fish meat

Fish muscle can be divided into two groups according to color:
ordinary muscle (white meat).
dark muscle (red meat) .
White meat forms the major portion of fish muscle and the dark muscle lies along the sides of the body under the skin and near the vertebrae .The shape and volume of red muscle vary according to the fish species.

Proximate composition of dark and white meat of some fishes

Fish species	Kind of meat	Moisture %	Crude protein %	Crude fat %
Tuna	D	66.4	22.9	6.7
	W	68.5	22.9	4.5
Sardine	D	70.0	15.9	12.8
	W	72.0	23.1	2.9
Mackerel	D	54.2	14.9	29.7
	W	65.5	21.2	13.1
Herring	D	57.8	15.5	28.2
	W	74.0	22.0	13.0
Cod	D	77.8	18.6	2.5
	W	78.4	19.9	0.5
Halibut	D	62.0	11.3	27.3
	W	77.7	14.5	7.0