CHAPTER I

INTRODUCTION

Thailand is one of the top ten (the 6th) leading countries in aquaculture production with 644,900 tons (FAO, 2004). Thailand is also one of the most important surimi production countries in Southeast Asia. In 1995, total production of surimi approximately 60,000 metric tons per year with 90% of products exported to Japan and South Korea (Morrissey and Tan, 2000). Threadfin bream is a major species of fish used in production of surimi, because of the white color, smooth texture, and strong gel-forming ability of the fish meat. Threadfin bream caught in Thailand normally includes three species, *Nemipterus hexodon*, which is the most used, *N. japonicus*, and *N. fergosus*.

Large quantities of water are necessary for the processing of seafood products and a considerable amount of fish water-soluble proteins (FWSP) is discarded. Of the muscle proteins from fish, approximately 65-75% is myofibrillar fraction (Mackie, 1996) that contributes to surimi production. However, 20-35% of muscle protein consists of water soluble, sarcoplasmic, proteins (Mackie, 1996) that are discarded with surimi wash-water. In Japan, an estimated 5,000 tons (dry weight) of FWSP are discarded annually in the waste water from surimi processing plants (Okazaki, 1994).

The fish sarcoplasmic proteins include myoglobin, hundreds of enzymes, and other albumins. Most of these proteins are enzymes involved in metabolic processes (Mackie, 1996). Metabolism involves specific pathways and associated enzyme systems. Therefore, differences in amino acid composition of sarcoplasmic proteins should be expected in different species. Ideally, the unique nature of the sarcoplasmic proteins of each species will be reflected in difference in protein characteristics and functional properties.

Fish sarcoplasmic enzymes involved with physiological events of cell activities, and they are the biological catalysts of the chemical reactions which muscle cells carry out in life. All six classes of enzymes (oxidoreductases, transferases,

hydrolases, lyases, isomerases and ligases) are present in fish muscle. The main enzyme groups known to affect the edible qualities of fish are transferases and hydrolases as well as enzymes associated with the glycolytic pathway.

It has been shown that transglutaminase (TGase) in fish also initiates setting of surimi gel (suwari) (Seki et al., 1990). Endogenous TGase is water soluble and can be removed if washing procedure is enough (Nowsad, Kanoh, and Niwa, 1994). High variability in the TGase activity of surimi is common and is due to a combination of factors. First, TGase is a water-soluble enzyme and thus its level can vary greatly with the type and extent of purification process used during surimi manufacture. Nowsad, Katoh, Kanoh, and Niwa (1995) showed that the sarcoplasmic fraction of fish can actually enhance the gelling ability when added back to surimi because of its higher TGase activity. Second, it is likely that different fish species, and perhaps different individuals within species, could vary in natural content of TGase, possibly affected by habitat, feed and physiological conditions (Lanier, 2000).

Of the hydrolase group, proteases (also termed proteinases) have been studied in relation to their surimi gel weakening (modori) effect. These proteases are classified into several groups including alkaline proteases and the cathepsins. An et al. (1994) have shown that although 90% of the enzyme can be removed through normal washing procedures, the remaining protease is sufficient to cause significant gel weakening; therefore, protease inhibitors can be used to improve surimi gelation. Because of the high levels of proteases in Pacific whiting, efforts have been made to recover the enzyme in the surimi wash-water.

The 20-35% of muscle protein currently discarded with surimi wash-water, could be recovered for utilization as food ingredient. Better utilization of such protein byproducts would increase their value and also reduce the cost of waste water treatment. At present, recovered proteins are mostly used as animal feeds and fertilizers because of the lack of techniques to use them as foodstuffs. At the present time, the functional properties of surimi discard protein are not well understood. In order to utilize fish sarcoplasmic proteins more effectively, the characteristics and functional properties of these proteins should be investigated thoroughly.

The overall objective of this study is to investigate the characteristics of sarcoplasmic proteins from threadfin bream, and its application as a food ingredient.

The specific project goals are,

1. To investigate the physicochemical properties and characteristics of sarcoplasmic proteins from ornate threadfin bream *N. hoxodon*.
2. To investigate the characteristics of protease activity from ornate threadfin bream sarcoplasmic proteins *N. hoxodon*.
3. To assess the functional properties of normal and modified sarcoplasmic proteins concentrate from ornate threadfin bream *N. hoxodon*.