Stability and redesign of the Sungkur fishing boats with the towed method in the coastal waters of South Kalimantan

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Abstract. This study investigates the static and dynamic stability of the Sungkur fishing boats, proposing a redesign. The study was conducted from February to April 2018. The research used a case study method. Data collection was carried out through observations, measurements, simulations and field experiments. Data analysis was carried out with simulations and numeric methods, using naval architecture formulas. The equipment used includes cameras, a GPS, measuring tools (waterpass, callipers, measuring threads, pendulum) and a computer. The results were interpreted descriptively. The results show that the Sungkur fishing boat with the towed method has good static and dynamic stabilities and has met the International Maritime Organization (IMO) minimum standard values. It also presents a good return energy, returning safely to its original position after destabilisation. The optimal redesign of the Sungkur fishing boat can be achieved by making several prototype changes toward improving the coefficients of fineness of the tested boats.
Key Words: coefficients of fineness, dragged gear, stability, Sungkur boat.

Introduction. The Sungkur fishing boat is usually used for catching fish and shrimp in the coastal waters of South Kalimantan, Indonesia. Typically, it is classified as a towed or dragged gear boat, which emphasises stability and speed. The Sungkur fishing boat has a slender body. The lines of the highest part of the bow and stern of the ship forms a vaked bow ('V') appearance, while the midship has an Akatsuki appearance ('U' shape). This is related to the fishing system of the ship, which focuses on the bow of the ship, starting from the net placement to the capturing process (Rusmilyansari et al 2017). Concerning the speed of the boat, the slender shape of the ship makes it able to move at high speeds. However, this is a disadvantage when considering stability, because the slender body causes the ship to easily destabilize, likely threatening the fishermen on board.

The Sungkur fishing boat prioritizes stability over speed, because the fishing gear is set in the water on the sides of the ship, a process that could destabilise it. Sometimes, a high speed is also needed in carrying out some fishing activities.

Manik (2007) states that each floating structure that moves on the surface always experiences isolation movements. Rolling is one of three types of pure isolation movements. This movement works under the return moment force, when the structure is disrupted from its equilibrium position. A boat moving on undulating waters will receive forces from the surrounding areas, where hydrodynamics forces cause other movements as a response. Therefore, the intensity of boat movements depends on the excitation torque generated by hydrodynamics forces, the direction of the waves, the damping force and the return moment force.

The stability is the ability of the ship to return to its original position after the ship has been destabilised due to other forces (Hind 1967). In contrast, Handryanto (1982) states that the stability is a combination of suitable size and division of load weight that allows the ship to follow wind strength and waves, being always able to return upright