IDENTIFICATION OF ELEVEN SHARKS CAUGHT BY TUNA LONG LINE USING MORPHOLOGICAL CHARACTERS OF THEIR FINS(*)

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SUMMARY

International concern about stock management and conservation of sharks has been enhanced in recent years. One of the most important issues in stock assessment of sharks is to estimate the amount of the landing and trading by species. At present, however, the landing of each species has not been recorded and usually data are obtained only from the trading amount of shark fins. Accordingly, it is important to investigate the morphological characteristics of shark fins in establishing a key to discriminate species.

In this study, shark fins from eleven species caught mainly by tuna long line were used for examination. Results of our examination revealed that the species were identifiable by the morphological characteristics of any fin among the first dorsal, pectoral and caudal fins.

RÉSUMÉ

Les inquiétudes suscitées à l'échelle internationale par la gestion et la conservation des requins se sont acccrues ces dernières années. L'une des questions les plus importantes concernant l'évaluation des stocks de requin est l'estimation du volume débarqué et commercialisé de chaque espèce. A l'heure actuelle, toutefois, les débarquements ne sont pas enregistrés pour chacune des espèces, et les données ne proviennent en général que du commerce des ailerons de requins. Par conséquent, il est important d'étudier les caractéristiques morphologiques de ces ailerons de façon à établir des clés permettant de distinguer les espèces.

Des ailerons de requin de onze espèces capturées essentiellement par les palangres ont été examinés pour les besoins de la présente étude. Les résultats de cet examen ont révélé que l'on pouvait distinguer les espèces d'après les caractères morphologiques de tout aileron de la première nageoire dorsale, de la nageoire pectorale et de la caudale.

RESUMEN

La précupación suscitada a escala internacional por la ordenación y conservación del stock de tiburones se ha visto incrementada en los últimos años. Una de las cuestiones mas importantes en la evaluación de stock de tiburones es la estimación del volumen de los desembarques y del comercio de las especies. Actualmente, los desembarques de cada una de las especies no se registran y, por lo general, los datos se obtienen sólo del comercio con aletas de tiburon. Por ello, es importante investigar las caracteristicas morfológicas de las aletas de tiburón para establecer una clave que permita distinguir las especies.

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En este estudio, se examinaron aletas de 11 especies pescadas en su mayor parte por el palangre dirigido a los túnidos. Los resultados de este examen mostraron que las especies podían identificarse por las características morfolçogicas de cualquier aleta: primera dorsal, pectoral y caudal.

INTRODUCTION

Fisheries directed to sharks are uncommon in Japan, and sharks captured with tuna long line fisheries are the major source of shark fin. Taniuchi (1990) reported that twenty five species of sharks were caught by Japanese tuna long line vessels. He also suggested that *Prionace glauca*, *Carcharhinus longimanus, C. falciformis, Isurus oxyrinchus, I. paucus, Pseudocarcharias kamoharai* and *Alopias superciliosus* are main species frequently caught in the open sea. In addition to these, fins of cold-water species such as *Lamna ditropis* and *L. nasus* and coastal species like *A. vulpinus, A. pelagicus*, *Sphyrna lewini* and *S. zygaena* are landed at Japanese main fishing ports. However, *P. kamoharai* could be excluded from the above list since it is too small to be utilized for shark fins. Therefore, fins of twelve species are regarded as being commonly treated at fish markets of Japan. Since shark fins are landed in dried or frozen state, the amount of landing of almost all sharks may be estimated according to their fin if dried or frozen fins can be identified to the species level. Fins from eleven species, except *S. Lewini,* could be sampled in this investigation. To confirm the shape and color patterns of each fin, we referred to Compagno (1984).

MATERIALS AND METHODS

The terms and measurement methods for each fin are described in Figure 1. The common and scientific names for ten species examined are shown in Table 1. Furthermore, shape and color of each fin were also observed from photographs.

RESULTS

Specific coloration of each fin was found for some species. Especially, *C. longimanus* was easily identified with their distinct white and black mottling marks on tip of each fin (Figure 2). The posterior margin edged with black may be used as a distinctive character for *I. paucus* (Figure 2).

The outer surface coloration of pectoral fin showed a difference from that of the inner side for many species. Accordingly, we easily identified the species from coloration. On the other hand, it was difficult to identify the species from coloration of first dorsal and caudal fins, because these fins showed few distinctive color patterns. However, other characters, e.g. shape and color of free rear tip or terminal lobe, were useful for identification of the sharks (Figure 3). Fins of *I. oxyrinchus* and *S. zygaena* have few distinguishing characters, but it is possible to identify the two species through the combination of different morphological characters (Figure 4).

Nevertheless, the case of *A. pelagicus* and *A. superciliosus*, it was difficult to identify the species of caudal fins due to the lack in distinguishing morphological characters. Consequently, the caudal fins of these two species must be traded with the first dorsal fin and the pectoral fin.

The above-mentioned morphological characters used for identification were also confirmed thorough photographs (Figures 2-4), suggesting the possibility of making a manual for identification by shark fins.

DISCUSSION

Eleven species of sharks were regarded as sharks caught by tuna long line in this study. The first dorsal, pectoral and caudal fins were examined to confirm whether or not they are useful for the identification of the sharks. As a result, shape and color of three kinds of fin were found to be effective. The identification key may be also applied to frozen shark fins. Therefore, we could identify almost all species of shark fins traded in Japan, which may lead to the estimation of quantities of the catch or stock for each shark species. In caudal fins of *A. pelagicus* and *A. superciliosus* which were difficult to identified by morphological characteristics, it is necessary to trade with first dorsal fin or pectoral fin, because these fins of two Alopiid sharks were identified to each species.

Of course, it is important that the effectiveness of the key described above should be tested in fact at fishing markets. In the next step, we intend to examine the key on the spot to make ascertain its effectiveness.

Only eleven species of sharks were examined as species exploited in the shark fin industry, although we believe they cover most of shark fins landed. It is important to establish a key to the species of sharks used for shark fins including species of potential use for shark fin. We excluded *S. lewini* in this study, because of failure to obtain fins of the species. In near future, we intend to collect more specimens including the *S. lewini*, which may be used for shark fin.

We checked the shape and color of each fin based on one specimen for each species in this study. However, variation in morphology of shark fins, due to growth and preservation, should also be investigated. We intend to investigate the variation of morphology by collecting more species and more specimens, in order to establish an identification method for shark fin.

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KEY TO THE SPECIES BY SHARK FIN

First Dorsal Fin

1a. Height of fin is longer than length of fin base----------2
1b. Height of fin is same as length of fin base----------9

2a. White and black mottling present on tip of fin----------*C. longimanus*
2b. White and black mottling absent on tip of fin----------3

3a. Free rear tip white----------*L. ditropis*
3b. Free rear tip not white----------4

4a. Posterior margin with a denticulated----------5
4b. Posterior margin without a denticulated----------7

5a. Uniformly black in color----------10
5b. Black to bluish color and partly other colors present----------6

6a. Posterior margin black without a white tip----------*I. paucus*
6b. Posterior margin not black with a white tip----------*A. vulpinus*

7a. Color slightly grayish on central part of fin----------*L. nasus*
7b. Color blue to brown without different color part----------8

8a. Fin thin colored with brown, length of free rear tip longer than one-third of length of fin base, height distinctly longer than length of base and free rear tip----------*S. zygaena*

8b. Fin thick colored with blue, length of free rear tip shorter than one-third of length of fin base, height same as length of base and free rear tip----------*I. oxyrinchus*

9a. Color black to blue with posterior margin sharply curved and V-shaped, length of free rear tip same as half of length of fin base----------*P. glauca*

9b. Color black to brown with posterior margin slightly curved, length of free rear tip longer than half of length of fin base----------*C. falciformis*

10a. Tip of fin broad and rounded----------*A. pelagicus*
10b. Tip of fin sharp and pointed----------*A. superciliosus*

Pectoral fin

1a. Shape slender, length of fin longer than three times the length of fin base----------2
1b. Shape broad, length of fin shorter than three times the length of fin base----------6

2a. Color brownish on outer side tipped with white and black mottling----------*C. longimanus*
2b. Color gray to brown outer side tipped with plain color----------3

3a. Color gray to brown on outer side and white on inner side----------4
3b. Color gray to brown in each side----------5

4a. Fin thick colored with gray around inner side, posterior margin with black denticulated, endoskeleton thick with loomed inner side----------*I. paucus*
4b. Fin thin colored with black tip of inner side, posterior margin is not denticulated, endoskeleton thin with loomed inner side----------*P. glauca*

5a. Color grayish on outer side with white tip and white mottling present on base of fin----*A. vulpinus*
5b. Color slightly white central part of inner side without white tip----------10

6a. Color grayish to brown on outer side and blackish on inner side----------*L. nasus*
6b. Color grayish to brown on outer side and white on inner side----------7

7a. Black spots present on inner side----------*L. ditropis*
7b. Black spot absent on inner side----------8

8a. Tip, anterior margin and posterior margin of inner side colored with black----------*C. falciformis*
8b. Inner side with plain color----------9

9a. Outer side brownish with a black tip and its posterior margin straight----------*S. zygaena*
9b. Outer side bluish without black tip and its posterior margin curved----------*I. oxyrinchus*

10a. Inner side with distinct white base and free rear tip----------*A. pelagicus*
10b. Inner side without distinct white base and free rear tip----------*A. superciliosus*

Caudal Fin

1a. Upper lobe longer than lower lobe and caudal keels absent----------2
1b. Upper lobe crescent in shape as long as lower lobe and caudal keels present----------6

2a. Upper lobe longer than six times of lower lobe----------3
2b. Upper lobe shorter than six times of lower lobe----------4

3a. Color grayish with white tip on lower lobe----------*A. vulpinus*
3b. Color blackish without a white tip on lower lobe----------10

4a. White and black mottling present on tip of each lobes----------*C. longimanus*
4b. White and black mottling absent on tip of each lobes----------5

5a. Length of lower lobe nearly as long as half of upper lobe----------6
5b. Length of lower lobe distinctly shorter than half of upper lobe----------*S. zygaena*

6a. Each lobes colored with black to blue and terminal lobe longer than one-forth of upper lobe--------
----------*P. glauca*
6b. Each lobes colored with black to brown and terminal lobe shorter than one-forth of upper lobe-----
----------*C. falciformis*

7a. Two keels present on caudal peduncle----------8
7b. One keel present on caudal peduncle----------9

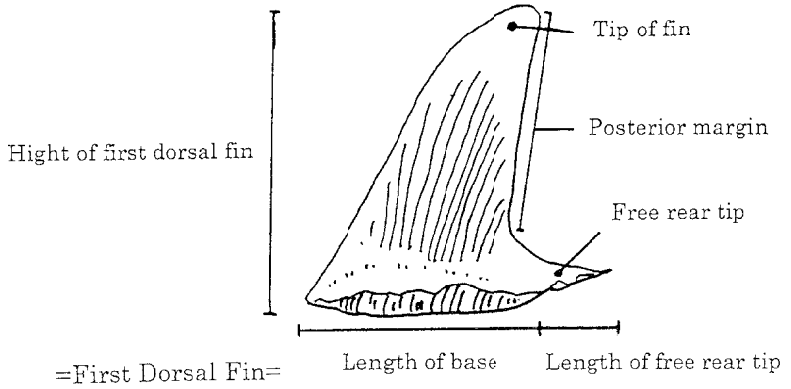
8a. Color slightly grayish on central part of lower lobe with black spots toward caudal peduncle--------
----------*L. ditropis*
8b. Color grayish with whitish posterior margin of upper lobe with white mottling toward caudal peduncle----------*L. nasus*

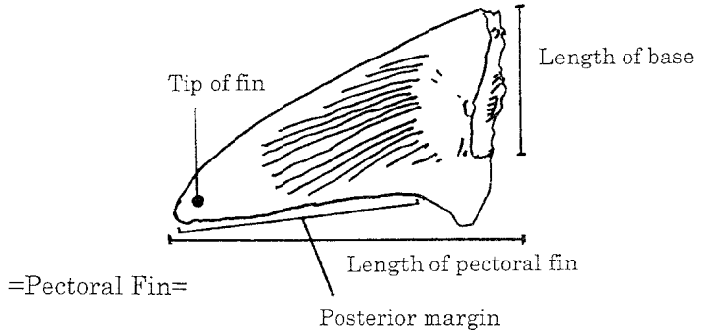
9a. Posterior margin of each lobes black denticulated----------*I. paucus*
9b. Posterior margin of each lobes without black denticulated----------*I. oxyrinchus*

10. *It is difficult to identify the species of* A. pelagicus *and* A. supercilosus *because we can not find the distinguishing morphological characters. Please trade these fins with first dorsal fin or pectoral fin.*

Table 1. Species name of shark fin samples used in this study

Common name	Scientific name
Pelagic thresher	*Alopias pelagicus*
Bigeye thresher	*A. superciliosus*
Thresher shark	*A. vulpinus*
Shortfin mako	*Isurus oxyrinchus*
Longfin mako	*I. paucus*
Salmon shark	*Lamna ditropis*
Porbeagle	*L. nasus*
Silky shark	*Carcharhinus falciformis*
Oceanic whitetip shark	*C. longimanus*
Blue shark	*Prionace glauca*
Smooth hammerhead	*Sphyrna zygaena*





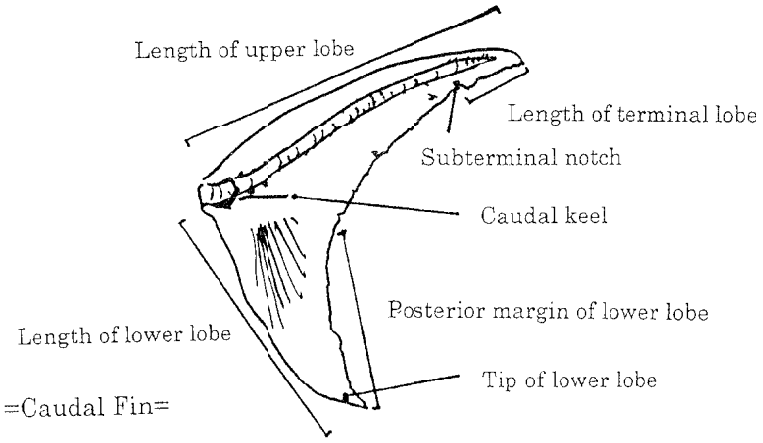


Figure 1. Technical terms and measurements of each fins

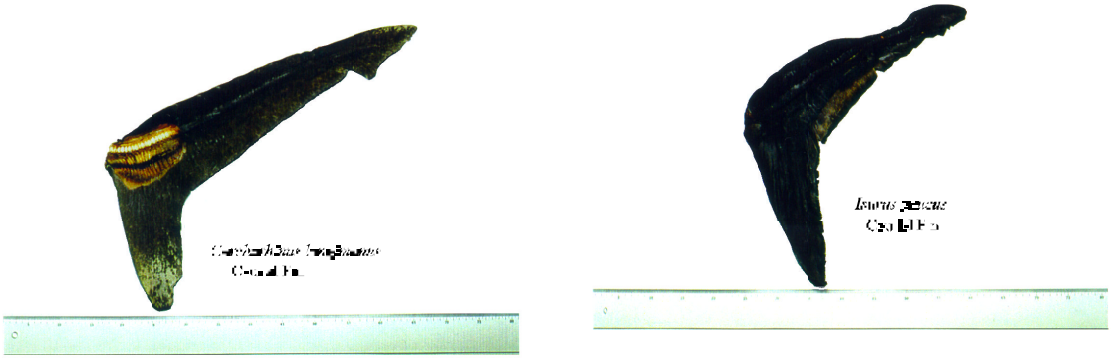
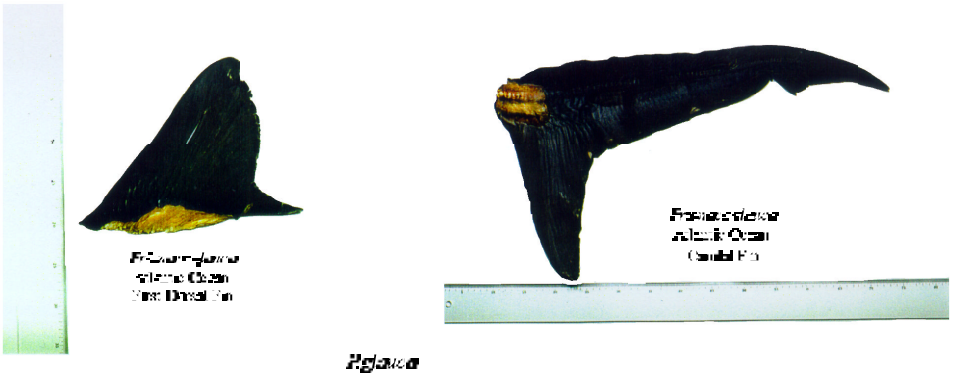
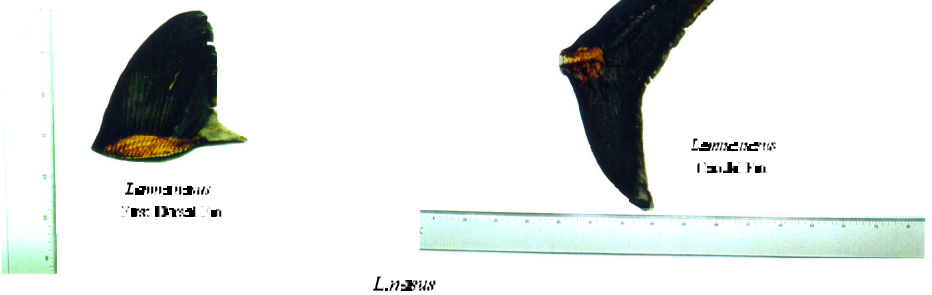


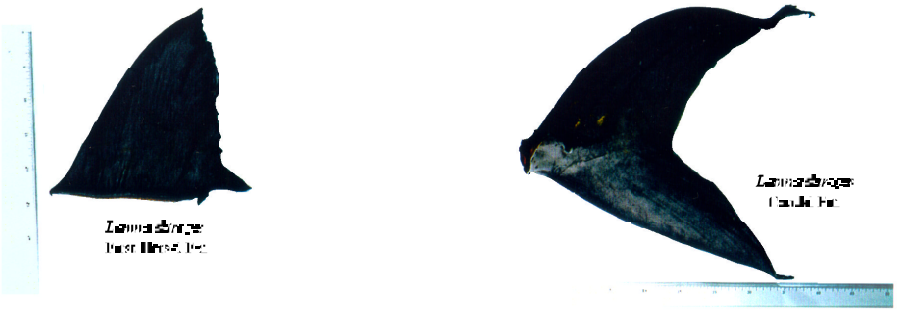
Figure 2. The shark fin with skin of *I.paucus* and *C.longimanus*



P.glauca



L.nasus



L.ferox

Figure 3. The shark fin with skin of first dorsal fin and caudal fin

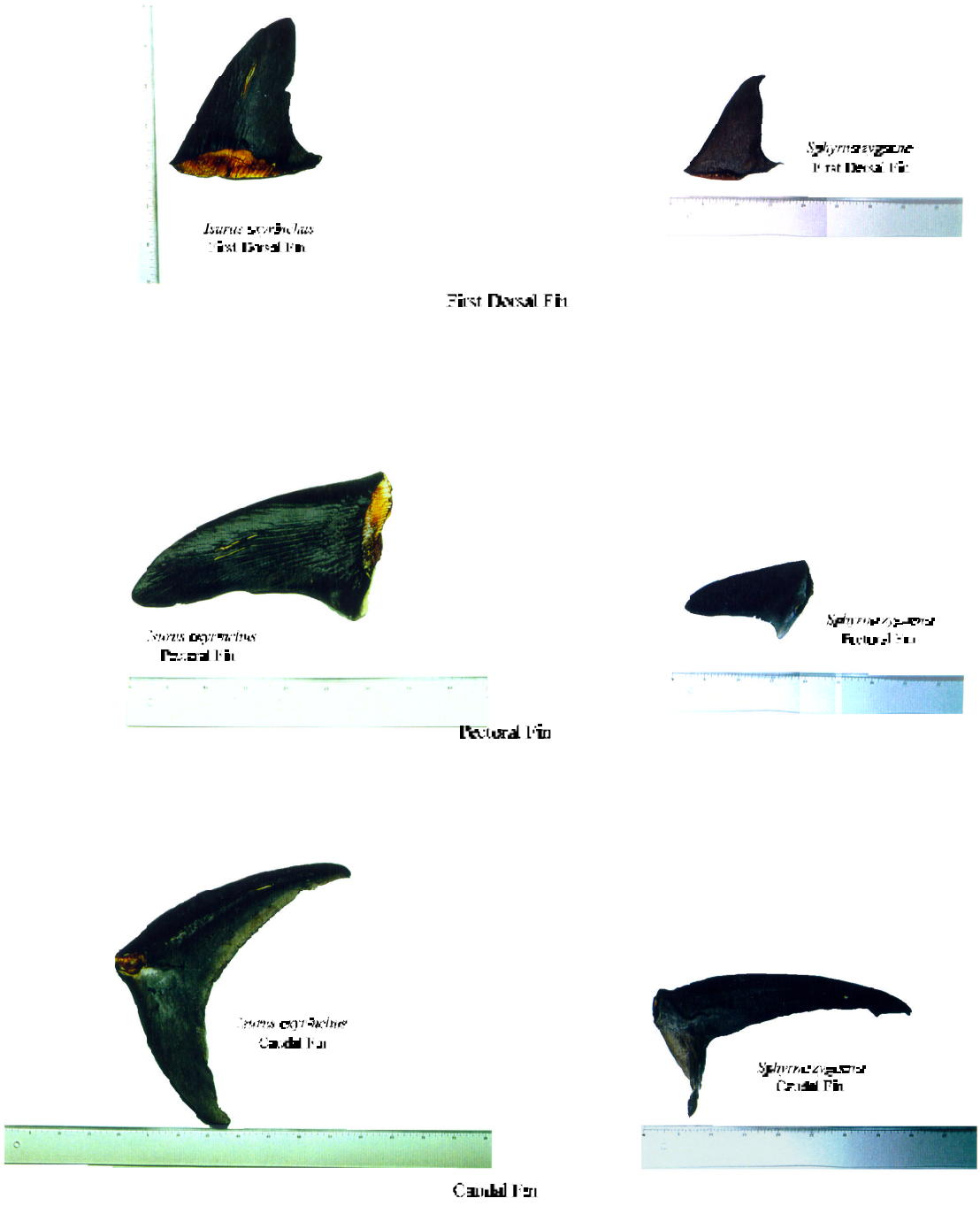


Figure 4. The shark fin with skin of *Loxyrhachus* and *Szygaena*